



**US Army Corps
of Engineers**

**Water Resources
Support Center**

Institute for Water Resources

Planning Manual

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Economic and Environmental Principles for Water and Related Land Resources Implementation Studies

These Principles are established pursuant to the Water Resources Planning Act of 1965 (Pub. L. 89-80), as amended (42 U.S.C. 1962a-2 and d-1). These Principles supersede the Principles established in connection with promulgation of principles, standards and procedures at 18 CFR, Parts 711, 713, 714 and 716.

1. Purpose and Scope

These principles are intended to ensure proper and consistent planning by Federal agencies in the formulation and evaluation of water and related land resources implementation studies.

Implementation studies of the following agency activities are covered by these principles:

- (a) Corps of Engineers (Civil Works) water resources project plans;
- (b) Bureau of Reclamation water resources project plans;
- (c) Tennessee Valley Authority water resources project plans;
- (d) Soil Conservation Service water resources project plans.

Implementation studies are pre- or postauthorization project formulation or evaluation studies undertaken by Federal agencies.

2. Federal Objective

The Federal objective of water and related land resources project planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.

- (a) Water and related land resources project plans shall be formulated to alleviate problems and take advantage of opportunities in ways that contribute to this objective.
- (b) Contributions to national economic development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the Nation. Contributions to NED include increases in the net value of those goods and services that are marketed, and also of those that may not be marketed.

3. State and Local Concerns

Federal water resources planning is to be responsive to State and local concerns. Accordingly, State and local participation is to be encouraged in all aspects of water resources planning. Federal agencies are to contact Governors or designated State agencies for each affected State before initiating studies, and to provide appropriate opportunities for State participation. It is recognized, however, that water projects which are local, regional, statewide, or even interstate in scope do not necessarily require a major role for the Federal Government; non-Federal, voluntary arrangements between affected jurisdictions may often be adequate. States and localities are free to initiate planning and implementation of water projects.

4. International Concerns

Federal water resources planning is to take into account international implications, including treaty obligations. Timely consultations with the relevant foreign government should be undertaken when a Federal water project is likely to have a significant impact on any land or water resources within its territorial boundaries.

5. Alternative Plans

Various alternative plans are to be formulated in a systematic manner to ensure that all reasonable alternatives are evaluated.

- (a) A plan that reasonably maximizes net national economic development benefits, consistent with the Federal objective, is to be formulated. This plan is to be identified as the NED plan.
- (b) Other plans which reduce net NED benefits in order to further address other Federal, State, local, and international concerns not fully addressed by the NED plan should also be formulated.
- (c) Plans may be formulated which require changes in existing statutes, administrative regulations, and established common law; such required changes are to be identified.
- (d) Each alternative plan is to be formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability. Appropriate mitigation of adverse effects is to be an integral part of each alternative plan.

- (e) Existing water and related land resources plans, such as State water resources plans, are to be considered as alternative plans if within the scope of the planning effort.

6. Plan Selection

A plan recommending Federal action is to be the alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment (the NED plan), unless the Secretary of a department or head of an independent agency grants an exception to this rule. Exceptions may be made when there are overriding reasons for recommending another plan, based on other Federal, State, local and international concerns.

7. Accounts

Four accounts are established to facilitate evaluation and display of effects of alternative plans. The national economic development account is required. Other information that is required by law or that will have a material bearing on the decision-making process should be included in the other accounts, or in some other appropriate format used to organize information on effects.

- (a) The national economic development (NED) account displays changes in the economic value of the national output of goods and services.
- (b) The environmental quality (EQ) account displays nonmonetary effects on significant natural and cultural resources.
- (c) The regional economic development (RED) account registers changes in the distribution of regional economic activity that result from each alternative plan. Evaluations of regional effects are to be carried out using nationally consistent projections of income, employment, output, and population.
- (d) The other social effects (OSE) account registers plan effects from perspectives that are relevant to the planning process, but are not reflected in the other three accounts.

8. Discount Rate

Discounting is to be used to convert future monetary values to present values.

9. Period of Analysis

The period of analysis to be the same for each alternative plan.

10. Risk and Uncertainty

Planners shall identify areas of risk and uncertainty in their analysis and describe them clearly, so that decisions can be made with knowledge of the degree of reliability of the estimated benefits and costs and of the effectiveness of alternative plans.

11. Cost Allocation

For allocating total project financial costs among the purposes served by a plan, separable costs will be assigned to their respective purposes, and all joint costs will be allocated to purposes for which the plan was formulated. (Cost sharing policies for water projects will be addressed separately.)

12. Planning Guidelines

In order to ensure consistency of Federal agency planning necessary for purposes of budget and policy decisions and to aid States and the public in evaluation of project alternatives, the Water Resources Council (WRC), in cooperation with the Cabinet Council on Natural Resources and Environment, shall issue standards and procedures, in the form of guidelines, implementing these Principles. The head of each Federal agency subject to this order will be responsible for consistent application of the guidelines. An agency may propose agency guidelines which differ from the guidelines issued by WRC. Such agency guidelines and suggestions for improvements in the WRC guidelines are to be submitted to WRC for review and approval. The WRC will forward all agency proposed guidelines which represent changes in established policy to the Cabinet Council on Natural Resources and Environment for its consideration.

13. Effective Date

These Principles shall apply to implementation studies completed more than 120 days after issuance of the standards and procedures referenced in Section 12, and concomitant repeal of 18 CFR, Parts 711, 713, 714, and 716.

These economic and environmental Principles are hereby approved.

DTIC QUALITY INSPECTED 2

Ronald Reagan

February 3, 1983

DRAFT PLANNING MANUAL

by

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for

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PREFACE

What is planning? Who does planning? How do they do planning? Why do planning at all? Can you even hope to get answers to these questions from the pages that follow? Perhaps - but let's make three points clear to start:

- This manual was prepared for *new Corps planners* with five or fewer years of experience. While this is our target audience, we hope that other professionals, people outside the Corps, and even more experienced planners will find something of value here.
- This is a *draft* manual. Please read it - more importantly, please use it. Then, tell us what you do and don't like about it; what should be added or dropped; and any other ideas that would make the manual more useful to you. We will consider all comments in preparing the final manual.
- This manual focuses on "*what is*", rather than "how to" (the subject of more detailed procedures manuals) or "why" (frequently a matter of policy). There are no clear lines to separate these areas of inquiry, however, and one person's definition of "what is" may be another's procedure for "how to" or explanation of "why".

This manual was prepared as part of the U.S. Army Corps of Engineers, Institute for Water Resources' Planning Methodologies Research Program. Ms. Jessica Fox, formerly of the Institute, was the Work Unit project manager and directed the development of this manual through February 1995; Mr. Kenneth Orth, of the Institute, is the current project manager. Mr. Michael Krouse is the Chief of the Technical Analysis and Research Division, Institute for Water Resources, and Program Manager for this research. Mr. Kyle E. Schilling is the Director of the Institute for Water Resources. Mr. Robert Daniel of the Corps Headquarters, Civil Works Directorate, Planning Division, is the Program's Technical Monitor; and Mr. Steven Cone, Headquarters, Civil Works Directorate, Planning Division, oversees this Work Unit.

Dr. Charles Yoe, College of Notre Dame of Maryland, was the principal author of this manual while working for The Greeley-Polhemus Group, Inc. under contract to the Institute for Water Resources. Dr. Yoe started his professional career as an economist in the Baltimore District, and has worked with many Corps District planners and the Institute over the past several years. In preparing this manual, he reviewed relevant planning literature, interviewed over 50 practicing Corps planners, and heard, weighed and reacted to views from our Advisory Group and others. His experience and knowledge continue to contribute to the Corps through this manual.

This manual would not be complete without an acknowledgment of the many Corps personnel responsible for its preparation and the process by which they guided its formation. From the outset, the content of this manual has been the invention of the Institute and an Advisory Group charged with its oversight. The Advisory Group of Corps personnel was supplemented by the involvement of other personnel from a wide variety of Corps offices. Planners throughout the Corps provided invaluable assistance in a series of interviews and the review of earlier versions of this manual.

The results of the initial interviews were compiled to identify issues of interest to Corps planners as well as a list of planning "do's and don'ts". This information was used to develop an initial outline for this manual which was presented to the Advisory Group at a May 1995 workshop. The first draft manual was prepared as a result of the Advisory Group's suggestions and direction.

The Advisory Group and others reviewed and commented on the first draft during the summer of 1995. The first draft manual was the subject of a second Advisory Group workshop in August 1995. The current form of this manual was crafted at that workshop.

The author would like to acknowledge and thank, without implicating, the following members of the Advisory Group:

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Mr. Michael Krouse, Institute for Water Resources
Mr. Robin Mooney, South Pacific Division
Mr. Kenneth Orth, Institute for Water Resources

What is planning? Who does planning? How do they do planning? Why do planning at all? Read on, and we will tell you what we have found. Practice it, and you can enlighten us with what you have discovered.

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ACRONYMS USED IN THIS MANUAL

ASA(CW) - Assistant Secretary of the Army for Civil Works

BCR - Benefit-cost ratio

BOB - Bureau of the Budget

CAP - Continuing authority programs

COE - Corps of Engineers

CPS - Creative problem solving

CW - Civil works

EC - Engineering Circular

EM - Engineering Pamphlet

EO - Executive Order

EPA - Environmental Protection Agency

EQ - Environmental quality

ER - Engineering Regulation

ETL - Engineering Technical Letter

FCSA - Feasibility Cost-Sharing Agreement

GIS - Geographic Information System

H&H - Hydraulics and hydrology

HTRW - Hazardous, toxic, and radioactive waste

ID - Identification

IWR - Institute for Water Resources

MCA - Military construction projects

MCEM - Multi-criteria evaluation methods

MTMC - Military traffic management command

NED - National economic development

NEPA - National Environmental Policy Act of 1969

No. - Number

NTIS - National Technical Information Service

O&M - Operations and maintenance

OMB - Office of Management and Budget

OSE - Other social effects

P&G - Principles and Guidelines

P&S - Principles and Standards

PCA - Project cooperation agreement

PED - Project engineering and design

PGL - Planning Guidance Letter

P.L. - Public law

PVA - Project validation assessment

RHA - River and Harbor Act

SAMP - Special area management plan

SD - Senate Document

SWB - Social well-being

U.S.C. - United States Code

WES - Waterways Experiment Station

WRC - Water Resources Council

WRDA - Water Resources Development Act

CHAPTER ONE: INTRODUCTION

**"WE MUST ASK WHERE WE ARE AND WHITHER WE ARE TENDING."
ABRAHAM LINCOLN (1809-1865) SIXTEENTH PRESIDENT OF THE UNITED
STATES.**

INTRODUCTION

Planning is problem solving and it is done throughout the U.S. Army Corps of Engineers organization. Some of it is done by planners in planning divisions on planning studies. Some of it is being done by people who never thought of themselves as planners. No matter who does it, planning is best when done well by people who understand and value it. This manual offers a rational and systematic approach to planning that is applicable to virtually any planning activities the U.S. Army Corps of Engineers needs to undertake.

Water resources planning is still the bread and butter of Corps' planning functions. Many water resource projects produce outputs that can be readily measured in monetary terms. Others produce outputs best measured in non-monetary terms. **National economic development (NED)** is the primary goal for most monetary project outputs like flood damage reduction and navigation. **Regional economic development (RED)** is the primary goal of a few others like drought preparation planning. Non-monetary water resource project outputs include ecosystem restoration and other environmental and social outputs. Though an NED evaluation is normally required for these studies, an NED justification, i.e., calculation of net NED benefits, is not explicitly required.

As national values and priorities change, new planning functions are emerging outside the realm of water resources. In this manual these are called simply, **other planning functions**. The outputs may be monetary or non-monetary. Rarely is an NED justification required for these other planning functions.

Planning within the Corps of Engineers is far more pervasive than most people would imagine. There are the traditional reconnaissance and feasibility studies for the typical single purpose project, that virtually everyone recognizes as planning. Then there are operations and maintenance budgeting problems, dredged material placement, major rehabilitation, environmental infrastructure, the regulatory program, military construction projects, project validation assessments, mobilization planning, master planning for military facilities, reservoir master planning, logistics planning, planning assistance to the States, formerly used defense sites, the installation restoration program, special projects, incidental Hazardous, Toxic and Radioactive Wastes (HTRW) issues, and strategic planning as examples

*What is planning?
How is it done?
Where do plans
come from?*

of some of the other newly emerging Corps planning functions. Planners have a great deal to offer to these planning activities.

It's of little importance whether planners are concentrated in one place in the organization or spread throughout it. What is important is that the people who are planning take pride in being planners. Planners are solvers of wicked problems. They are shapers of the future. They are generalists with a specialty. They are the kinds of people 21st century organizations are going to need.

Few people are trained as planners. Most learn on the job. To be a good planner, however, one needs to know how to go about planning. There has to be an approach to planning problems. A planner needs a framework upon which plans can be built. Over the last two centuries, a remarkably simple and flexible planning process has emerged in the water resource development field. It is, in fact, one of the most logical and best described planning processes to be found anywhere. The six-step planning process currently used by the Corps, applicable to all the Corps' water resources and other planning functions, is described and elaborated upon in this manual.

What is planning? How is it done? Where do plans come from? Elementary questions, yet experience shows the answers are not so easily derived. Answering them is the goal of this manual.

PURPOSE AND AUDIENCE

The purposes of this manual are threefold. First, it explains what planning is. Second, it explains how planning is done by the Corps of Engineers. Third, it introduces some common challenges and opportunities that Corps planners will face at the turn of the century. Its focus will be on water resources planning, though the principles, tools and methodologies discussed are equally applicable to other planning functions as well.

The target reader for this manual is the Corps planner with less than five years of experience. To the extent the manual succeeds in explaining the basic tenets of planning in general and the Corps' planning process in particular it may also be of interest to non-planners within the Corps as well as non-Federal partners and members of the general public. Experienced Corps planners may also find the manual to be a useful refresher.

This is not a comprehensive planning document in that it does not repeat in detail the guidance or planning procedures that can be found in other documents. Nor does this manual provide a cookbook approach to planning. As the reader will learn, that would be antithetical to the planning process.

The manual has been written so you can read from it selectively, though it is most congruent and complete if read in its entirety. Readers are encouraged to browse through the manual and read it selectively. A measure of redundancy has been added to ease the burden of those who do read this manual a piece at a time.

ORGANIZATION OF MANUAL

The manual consists of 14 chapters and three appendices as shown in Figure 1. The first four chapters are introductory in nature and explain what planning is. Chapter Two defines planning generally, and the Corps' six-step planning process specifically, as a rational problem solving process. The basic terminology and concepts needed to understand the greater content of the manual are presented here. Chapter Three provides a brief history of water resource planning by the Corps. This history is presented against the backdrop of the larger issues of water resources development in the United States. The final introductory chapter, Chapter Four, provides an overview of the key planning guidance that directs the plan formulation process. These are primarily the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (a.k.a., Principles and Guidelines or P&G) and Engineering Regulation (ER) 1105-2-100 Guidance for Conducting Civil Works Planning Studies.

The next seven chapters address the questions of how planning is done and from where plans come. This is done in a detailed discussion of selected elements of the Corps' **six-step planning process**. A separate chapter is devoted to each of the planning steps. Chapter Five, however, first discusses iterations and screening, two essential concepts that run throughout the six planning steps. Chapter Six addresses the first step, **identification of problems and opportunities**. Substantial emphasis is given to the specification of **goals, planning objectives, and constraints** critical steps in the formulation process.

Chapter Seven covers the second step of the plan formulation process, the **inventory and forecast of resources**. Step three, the **formulation of alternative plans**, is covered in Chapter Eight. The next chapter addresses **plan evaluation**, the fourth major planning step. Chapter Ten discusses the **comparison of plans** and Chapter Eleven describes the sixth and final step in the planning process, **plan selection**. Though these steps are presented in separate and discrete chapters the conduct of the steps in actual practice is anything but separate and discrete. In practice the planning steps entail a great deal of overlap, iteration and even ambiguity.

The last three chapters address topics of special interest to Corps planners at the turn of the century. Chapter Twelve focuses on environmental planning. It identifies the growing extent of environmental planning throughout the Corps. Chapter Thirteen deals with some problems and constraints that planners

Figure 1: Organization of Manual

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PREFACE	CHAPTER 12: PLANNING AND THE ENVIRONMENT
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frequently encounter in the planning process. The final chapter looks at opportunities and new directions for Corps planners.

The three appendices were designed to provide information of a general nature that did not fit neatly into the body of the manual. Appendix I presents a glossary of some common planning terminology. Appendix II presents a list of current guidance related to the planning process. Appendix III is a list of plan formulation do's and don'ts culled from the collective wisdom of dozens of Corps planners interviewed during the preparation of this manual.

...the six-step planning process...offers a rational, systematic, and flexible approach to planning that can be used for any planning activity in the Corps' organization.

As noted above, the manual has been written so that it can be read selectively. The only loss of continuity is likely to be an occasionally unfamiliar term or phrase. To assist readers who find themselves in this situation an index is provided at the back of the report along with a list of references. Quotation boxes, in which parts of the text are excerpted, are used to highlight the more important ideas in the chapter. In addition, liberal use of italics is made to further direct the selective reader's attention to the more important ideas of the chapters. Sidebar boxes are used to introduce details and explanations that are not essential to the general flow of the material.

SUMMARY AND LOOK FORWARD

This manual provides an introduction to planning in the Army Corps of Engineers. The following chapter defines planning in general terms and then introduces the six-step planning process the Corps uses, which is essential knowledge for all Corps planners. It offers a rational, systematic, and flexible approach to planning that can be used for any planning activity in the Corps' organization.

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CHAPTER TWO: PLANNING DEFINED

"We should all be concerned about the future because we will have to spend the rest of our lives there." CHARLES F. KETTERING (1876-1958) AMERICAN ENGINEER AND INVENTOR.

INTRODUCTION

P&G and the Corps

Over the Nation's first two centuries U.S. water resource development policy has evolved to what it is now. Currently, and since 1983, the principles, standards and procedures that guide water resource development at the national level are articulated in the Principles and Guidelines. The P&G were "...developed to guide the formulation and evaluation studies of the major water resource development agencies" In prior years each water resource development agency had developed its own formulation and evaluation procedures. The P&G is the most recent effort to standardize these practices.

Consequently, to characterize the P&G's six-step planning process as the Corps' planning process could be misleading. It is indeed the Corps' process in that it is the process the Corps follows. However, it was neither developed by the Corps nor restricted to the Corps' use. Other agencies use the P&G's planning process to varying extents.

Planning is a creative process. Like many creative processes it can tend to be unstructured and ad hoc, at times bordering on chaotic. It is unequal measures of experience, analysis, intuition and inspiration. There are many ways to add structure to this process. The one used by the Corps has been promulgated by the Federal government in the Principles and Guidelines. Inasmuch as this planning process has been adopted by the Corps, it is referred to simply as the Corps' planning process throughout this manual. It provides a flexible, systematic, rational framework from which planners can work and to which they can return when chaos threatens. It provides general guidance on how to proceed and a logical means of describing the thought processes that might otherwise remain opaque to others. This chapter defines planning by example, then introduces the Corps' planning framework. That framework is described at length in subsequent chapters.

Three questions are the focus of this chapter. The chapter begins by answering the question, "what is planning"? It then answers the "how it is done?" question with an overview of the Corps' planning process. It next turns to the question, "where do plans come from?" by

introducing some basic notions of plan formulation, a significant step in the planning process.

WHAT IS PLANNING?

What is planning? That seems a simple enough starting point for our discussion, but *a review of the literature reveals a wide range of opinion and very little*

consensus on what planning is.¹ The following sections offer several definitions of planning. They are summarized in Table 1.

Though we'll offer a working definition, it is not important that you agree. Pick the definition that most appeals to you. It is far more important to have a sense of the big picture of what planning is about than that you agree with any one of the definitions offered here.

Table 1: Planning Defined

- Basic human activity
- Rational choice
- Control of future action
- Special kind of problem solving
- What planners do

PLANNING AS A BASIC HUMAN ACTIVITY

Some see planning as a basic human activity that pervades our behavior at every level of society. In this view, planning is a process of human thought followed by action based upon that thought. This makes planning a very general human activity.

You plan what to wear to work, the route to take to the office and what to have for lunch. This makes planning very ordinary. At the same time, it does not preclude the notion of expertise. Many people run. Few of them devote themselves to running to the point they become Olympic athletes. Likewise, though everyone plans, few do it as well as the professional planners.

...important to have a sense of the big picture of what planning is about...

If planning pervades human activity then surely it pervades the development and use of water and related land resources and the performance of the Corps' various missions. We, as a society, think about water resources then take actions based on those thoughts. These activities are complex enough, however, to require the services of experts.

PLANNING AS RATIONAL CHOICE

This view of planning is confined to matters of deliberate choice. It emphasizes the link between planning and rationality. *Planning thus becomes a process for determining appropriate future actions through a sequence of choices. It is a structured rational approach to achieving desired ends.*

¹ The material in this section is adapted largely from Ernest R. Alexander's article, "Planning Theory" found in *Introduction to Urban Planning* edited by Anthony J. Catanese and James C. Snyder.

As subsequent chapters will reveal, water resources planning is nothing if it is not a rational decision-making process. The rationality of the six-step planning process used by Corps planners is undeniable.

PLANNING AS CONTROL OF FUTURE CONSEQUENCES

Planning may be seen as an attempt to control future consequences through present actions. This view fuses planning and action together, for if we do not implement a plan there can be no control exerted over the future. Some would measure the success of planning by the future consequences we are able to control.

The Corps' planning framework relies extensively on the consideration of future consequences. The comparison of future scenarios without and with a project in place is central to the Corps' planning process.

PLANNING AS A SPECIAL KIND OF PROBLEM SOLVING

Another stream of thought is that planning is problem solving that is aimed at very particular kinds of problems. Planning theorists have defined the problems they deal with as "wicked" problems. *A wicked problem is one with no clear answers, solutions are only better or worse.* The data available to solve these problems are usually messy. There are no rules for approaching wicked problems and no clear tests to formulate or judge their solutions. *Water resource problems are always wicked problems.*

PLANNING IS WHAT PLANNERS DO

Planners help decision-makers identify their problems, conceive solutions to them, and compare the importance of the inevitable conflicting values inherent in any solution. This is a simple and intuitive definition with which many Corps planners can identify. The job is so unique and different from day-to-day that it defies a more precise definition.

If planners are simply people who plan and planning is simply what planners do, we are back where we started without a definition. The definitions offered here are not mutually exclusive. They are overlapping and somewhat imprecise, but taken together they provide a fairly reasonable picture of what planning is. To further sharpen that picture let's consider what planning is not.

WHAT PLANNING IS NOT

Though brief, this review of what planning is makes several points clear. First, there is no consensus on what planning is. Second, it is easy to see the

elements of what the Corps planner does in each of the definitions. It may be helpful at this point to consider a few things that planning is not.

The planning we are concerned with is not a purely individual activity. It is done by individuals in a team environment to affect groups of people. While there may be personal planning, that is not the concern of this manual. Additionally, *planning is not present-oriented.* Planning is primarily concerned with the future. Future actions and their consequences involve substantial uncertainty.

Planning cannot be routinized. Problems that are not unique can be approached with existing solutions or problem-solving algorithms, such as standard operating procedures, rules, or programs. These problems, however, are not the wicked problems that planners confront. Let this serve as fair warning to the reader, there will be no standard operating procedures for planning found in this manual!

Planning is...the deliberate social or organizational activity of developing an optimal strategy for solving problems and achieving a desired set of goals.

Planning is not a trial-and-error process. It is not experimental. It is a focused, thoughtful and rational process. The plans themselves may involve feedback loops, monitoring, evaluation and adjustment. Adaptive management is a concept the Corps encourages for ecosystem restoration plans. The point is that *while it may be reasonable for the plans themselves to be experimental the planning process should never be.*

Neither is planning just the imagining of desirable futures. While specifying objectives and creating alternative plans to achieve them are extremely important parts of the planning process, they are not sufficient for planning. *Planning is more than utopian thinking. The intention to implement plans and the power to do so are essential elements of planning.* Planning is not done for planning's sake. Do not confuse the planning process with the report writing or the review process. Planning goes well beyond completing a report.

If planning is not an individual action, not routinized, not trial-and-error, not academic or utopian, then what is planning? Planning is societal, future-oriented, non-routinized, deliberate and action-oriented. Planning is here defined as *the deliberate social or organizational activity of developing an optimal strategy for solving problems and achieving a desired set of goals.*

HOW IS PLANNING DONE?

Planning is done by people in a sequential, multi-staged process in which many of the stages are linked to their predecessors by feedback loops. Conclusions reached at

a later stage of the planning process may lead to revisions of an earlier stage or another iteration of the entire process. The specific sequence and stages of a planning process vary with the type of planning and the institutional setting in which the planning is done. Generalizations about how planning is done are reflected in the two planning models that follow. The first is a generic model of the planning process, the second introduces the planning model used by the U.S. Army Corps of Engineers in its Civil Works activities.

A GENERIC PLANNING MODEL

There is no such thing as "the" planning model. Planning models abound in the literature. The major components in Table 2 can be found in most of the planning models in general use.

Table 2: Two Planning Models

Generic Model	Corps Model
1. Problem diagnosis	1. Identify problems & opportunities
2. Goal articulation	2. Inventory & forecast resources
3. Prediction and projections	3. Formulate alternative plans
4. Alternative development	4. Evaluate plan effects
5. Feasibility Analysis	5. Compare effects of alternative plans
6. Evaluation	6. Select best plan
7. Implementation	

Planning often begins with some notion that we are dissatisfied with the status quo. If there is no problem there is no reason for plans or actions. Diagnosis of the problem requires an image of a desired state.

Goals relate to problem definitions. Translating vague, incoherent or conflicting goals into operational objectives is one of the toughest jobs a planner faces.

Solving problems and achieving goals always involves moving from where we are now to some different place in the future. Prediction is essential for evaluating and selecting alternatives and moving to future places. We need to make some guesses about the future to formulate and evaluate plans.

The development of alternative plans has a profound effect on the quality of the final decision. As Lichfield has said:

"The ability of an evaluation exercise to demonstrate the comparative merits of possible courses of action is limited, ultimately, by the quality of the plans put forward for assessment.

A "good" plan cannot be chosen from a "poor" set of alternatives."²

Where do alternatives come from? They must be generated by some mix of experience, analysis, inspiration, and creative invention.

Feasibility analysis asks, can the alternatives be done given known constraints and available resources? Evaluation begins when planners have a number of alternatives they know can be implemented. Which alternative do you like most? What does it do for you? The answers to these questions depend on the evaluation criteria you use: benefit-cost analysis, cost-effectiveness, environmental quality, other social effects, program output indices, etc.

Implementable plans seem to require a strong political commitment, though that is not a sufficient condition. Plans that can be implemented within existing organizational frameworks are more likely to succeed than complex plans that require new institutional structures and relationships.

...alternatives...must be generated by some mix of experience, analysis, inspiration, and creative invention.

There are any number of ways to include these basic tasks in a planning process. The Corps of Engineers' planning process, as embodied in the Principles and Guidelines, is but one of many possible planning models. It is one of obvious interest here, however, for it is the focus of this manual.

THE CORPS' PLANNING MODEL

The direct correspondence of the generic planning model with the Corps' six-step planning process is also shown in Table 2. The language used in the generic model differs for the last three steps, however the elements of the steps indicate a clear correspondence in concept and theory. The two models together show the Corps' planning process is consistent with good planning theory.

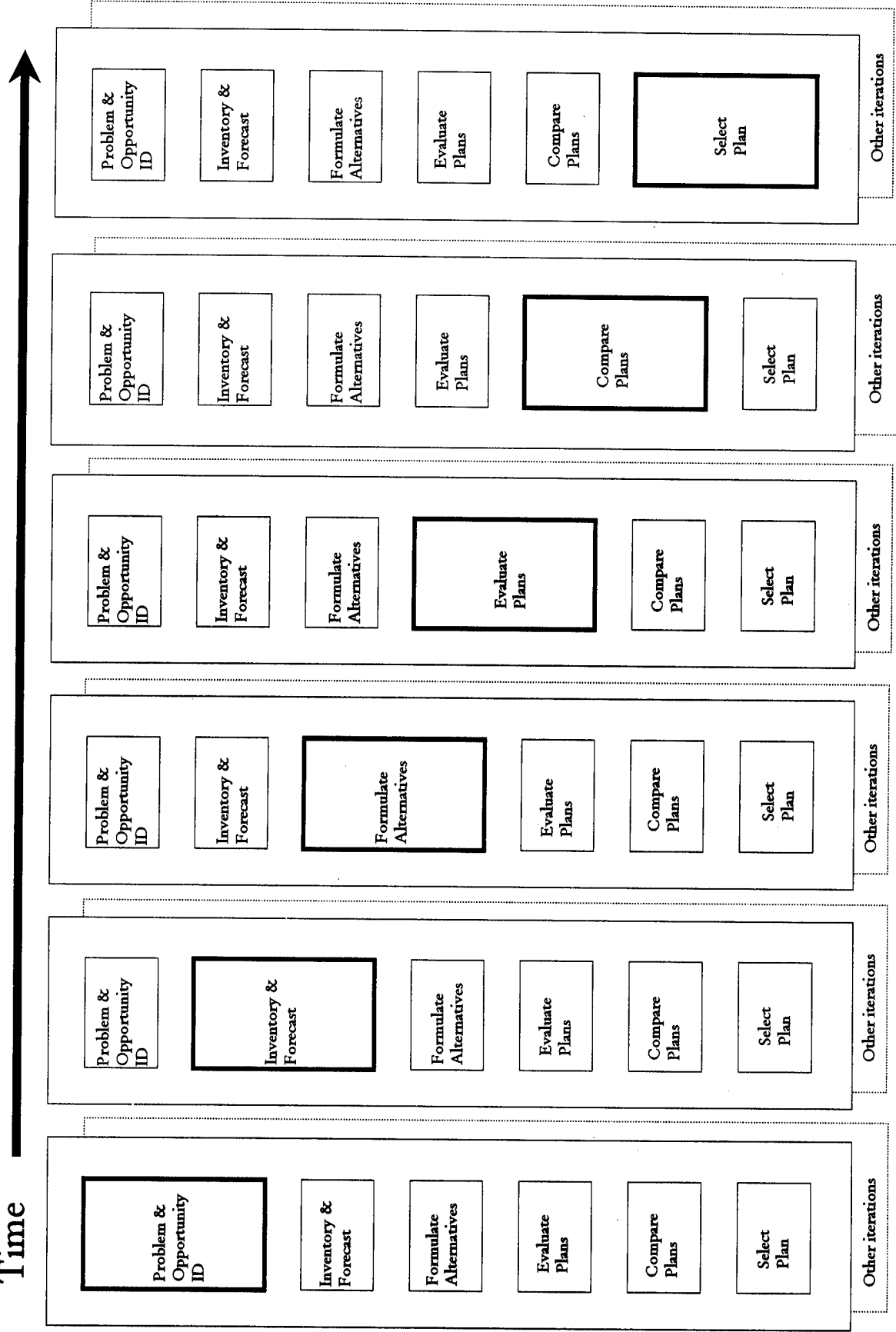
Though the Corps' process is presented as if it is a simple sequence of six rational steps it is not that easy. No clean lines can be drawn among the steps in the Corps' planning process. Problem definition, goal setting, devising alternative solutions, etc. are more simultaneous activities that wax and wane throughout the process with the relative importance of each step varying from time-to-time, often in an unpredictable manner. The steps do, however, suggest that the emphasis in the planning process will from time-to-time change to one of these activities as shown in Figure 2.

² Lichfield, Nathaniel, Peter Kettle, and Michael Whitebread. *Evaluation in the Planning Process*. Oxford: Pergamon, 1973, p. 13.

Figure 2: Corps' Planning Process

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Time



In the beginning, the emphasis will be on step one, identification of problems and opportunities, even though work may be proceeding on the other steps. There may even be several iterations or passes through the steps in which step one is emphasized. But, in time the emphasis will shift to step two, as the second large rectangle indicates. At this stage in the planning study there may be one or more iterations through the various steps but the emphasis is clearly focused on the second step. This process of iterating through the steps continues with a continually shifting emphasis on the next step.

The steps are presented in a linear fashion in the P&G but the planning process is anything but linear. At times it borders on chaotic. But always it comes back to the order imposed by the rational framework present in the steps. There is a chapter on each of these steps later in the manual. For now, we simply list the steps. It is easy to see the relationship of the Corps' specific model to the generic planning model. The generic steps have in essence been restated in a water resources context.

The six-step planning process is described in the P&G as follows:

- 1) *Specification of the water and related land resource problems and opportunities (relevant to the planning setting) associated with the Federal objective and specific State and local concerns.*
- 2) *Inventory, forecast, and analysis of water and related land resource conditions within the planning area relevant to the identified problems and opportunities.*
- 3) *Formulation of alternative plans.*
- 4) *Evaluation of the effects of the alternative plans.*
- 5) *Comparison of alternative plans.*
- 6) *Selection of a recommended plan based upon the comparison of alternative plans.³*

CHARACTERISTICS OF THE CORPS' PLANNING PROCESS

An overview chapter like this is not the place to try to characterize the Corps' planning process. That's the purpose of the manual. Nonetheless, there are a few characteristics of the Corps' planning process that are too important to hold off until later. These we introduce now.

³ Section III paragraph 1.3.2(a) of *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*.

An Iterative Process of Overlapping Steps

Someone unfamiliar with the planning process might look at the preceding section and think, first you do step one, then step two, and when you get to step six you're done. Nothing could be further from the truth. Planning is not neat. It's not linear. It's not always sequential. It is an iterative process. The steps are repeated many times. How many? As many as necessary.

Thinking About Iterations

The text says the steps are sometimes simultaneous and sometimes not even sequential. Some planners took issue with that view during the preparation of this manual. There was less disagreement about what really happens in planning than with how we try to describe it in words to others.

Do we ever begin to collect data before the problems have been identified? That is, does step two ever precede step one in the early stages of a study. Some say yes. It's essential that you begin to collect data experience tells you will be needed, for example hydrologic data. In this view of planning we can have a non-sequential process. The opposing view of the same situation is that some of step one has been done before the data collection begins. It may have been an implicit and even instantaneous preliminary assessment of problems but it was a step one activity.

Choose whichever view pleases you most. It's really not too important. What is important is that you learn how to think about planning and how it should be done. It is less important to determine whether step two preceded step one or there really was some step one activity in there, than it is to understand that the overall process needs structure. The six steps provide that structure. Some iterations will omit or de-emphasize some steps at times. That's okay. But, before one can ultimately proceed to final iteration of any step all the prior steps must be completed.

If planning were a cake it would be a marble cake, with swirls of each step intermixed in unique and interesting ways throughout the final product. It most certainly would not be a layer cake with neatly defined steps as layers. Planning often begins and proceeds with a multi-step flurry of activity. The disciplined logical approach to planning begins with problem identification (step one). Data collection begins simultaneously (step two). Study team members begin to form notions about applicable measures almost immediately (step three). Impressions about the relative merit of the different measures are formed concurrently (step four). Comparisons of these embryonic notions are inevitable (step five). An individual may have already identified the solution to the problem (step six) in their own minds before step one begins.

Planning is a discovery process. There are successive iterations of increasing amounts of information and a decreasing number of alternative plans of action. The steps in the process are continuous rather than discrete. We do not always complete step one before proceeding to step two. Many steps can be begun at once. Several steps may be going on at the same time. Steps completed are often returned to. The step sequence is a logical one that describes the general progression of planning. It is not a formula for planning. The reality of iterative planning is so important that this is one of the primary subjects of Chapter Five.

Scoping and Screening

Planning typically begins with very little information in hand but a vast sea of information from which to choose. As a study begins, conceptually any measure is a potential candidate

for implementation in an alternative plan. As the study progresses more information is obtained.

With so much information and so many possible plans it is necessary to find a way to identify what is important. This is the **scoping** process. *Scoping identifies those things that need to be considered.* Scoping is used to determine which problems and opportunities will be addressed. It is used to decide what data are necessary and what are not.

Everything hinges on the planning objectives; get them right, use them and things will go a lot easier.

Screening is the process of separating what is important from what is not. It distinguishes what is valuable from what is worthless. It is the process of systematically eliminating options from the choice set. The choice set may be the measures that can be used to formulate plans or it may be plans that have been formulated. These two concepts are discussed further in Chapter Five.

Objective Attaining Process

As practiced by the Corps of Engineers, plan formulation is an objective-oriented process. Problem solving is at the heart of this process. Correcting existing problems and avoiding future problems are equally important. The former needs are called **problems**, the latter, because of their future orientation, are considered **opportunities**.

Once the planning area's problems and opportunities are identified, objectives are specified that, if met, will solve those problems and capitalize on those opportunities. Plans are developed that will address the objectives to varying extents. The plans' accomplishments of the objectives are measured and compared. From these plans, the best plan is selected. Everything hinges on the **planning objectives**; get them right, use them and things will go a lot easier.

Constraints

Constraints have two close but different meanings in the planning process. First, a constraint is something that confines us. It renders certain things impossible. In this sense resources can constrain the planning process. Time, expertise, money, policy, authority, etc. limit our abilities to consider certain problems and their solutions. A second meaning of constraint is something that restricts us. Though certain actions may not be impossible, they should not be done or they may not be permissible. In this sense constraints can restrict the planning process. Thus *we have constraints on the planning process and planning constraints as two different concepts*, both of which are considered further in Chapter Six.

Planning Should Be Interdisciplinary

If planning is a systematic problem-solving process and if the problems are complex and "wicked", then no one person is capable of solving them. A team is needed. A planning team will require many disciplines. A team of many disciplines is a multi-disciplinary team.

A multi-disciplinary team does not become interdisciplinary until the various disciplines begin to hear and listen to one another's viewpoints. On an interdisciplinary team, the team members become planners, i.e., generalists with specialties. There must be a synthesis of viewpoints in order for the community to obtain maximum advantage of the collective expertise of the team's members.

Too often, the simple assembly of people of varied backgrounds is considered to constitute an interdisciplinary team. *Until the team leader succeeds in facilitating the cross-fertilization of ideas and the generation of a synergy that can only come from functioning as a team and not a collection of disparate individuals, planning remains multi-disciplinary and falls short of the interdisciplinary planning goal.*

Ubiquitous Public Involvement

Public involvement is a process by which interested and affected individuals, organizations, agencies, and governmental entities are consulted and included in the Corps' planning and decision-making activities. Public involvement has to be everywhere in the planning process. The Federal and non-Federal partnership must constantly inform, include, consult and be informed by stakeholders. Public involvement does not begin and end at discrete points in the planning process, it runs throughout each of the six-steps of the planning process in all their iterations.

There is are a subset of the public of particular interest to planners. *Stakeholders are those people or groups who can stop you or whose support is needed for success.* These include the partners, state government, resource agencies, EPA, etc. A planning process that ignores a stakeholder is doomed to failure.

TYPES OF PLANNING AND PLANNERS

Planning is best done by planners. In this section we consider some of the planning specialties and who planners are.

GENERIC TYPES OF PLANNING

The present-day planning profession has emerged in response to the growth, changing values and critical problems of twentieth-century urban

development. Though planning theory may have developed around the needs of cities, there are many different types of planning, water resources development planning being but one example.

Based on the variety of definitions of planning offered above, we are able to identify a rather lengthy list of different planning specialties. Table 3 shows the areas of specialty recognized by the Association of Collegiate Schools of Planning. Interestingly, the typical Corps planner may find herself involved in virtually all of these specialty areas at one time or another.

Table 3: Selected Planning Specialties

- Land Use Planning
- Policy Planning & Management
- Transportation Planning
- Housing & Community Development
- Human Services Planning
- Historic Preservation Planning
- Economic & Resource Development Planning
- Environmental Policies Planning
- International Development Planning
- Urban Design and Physical Planning
- Computers in Planning

Source: Association of Collegiate Schools of Planning

PLANNING IN THE CORPS OF ENGINEERS

The first chapter introduced the idea that Corps' planning functions can be divided into two broad categories. *One of these is water resources planning, still the bread and butter of the Corps' formal planning responsibilities.* Table 4 lists the water resources project purposes and the Corps' continuing authority programs. These plans are typically documented in one of the types of reports shown in Table 5. *The second set of formal planning responsibilities includes other planning activities such as those shown in Table 6.*

There is a perception among some Corps personnel that the number of water resource planning studies has declined in recent years and the Corps' planning function is on the wane⁴. If we think only of traditional flood damage reduction and navigation studies this may be true for some districts. However, water resources planning encompasses a much broader spectrum of activities than

⁴ During the preparation of this manual this point was contested by some and affirmed by others. All agreed, however, that some empirical study is needed to document the recent trends and current state of planning Corps wide.

Table 4: Types of Project Purposes

- Navigation
- Flood damage reduction
- Shore protection
- Hydroelectric power
- Recreation
- Water supply
- Fish & Wildlife enhancement
- Ecosystem restoration
- Continuing authorities programs
 - Section 14: Emergency Streambank & Shoreline Erosion
 - Section 103: Beach Erosion Control
 - Section 107: Navigation
 - Section 111: Mitigation of Shore Damage
 - Section 205: Flood Damage Reduction
 - Section 208: Snagging & Clearing (Flood)
 - Section 1135: Environmental Improvement
 - Section 204: Beneficial Uses of Dredged Material

Table 5: Types of Planning Reports

- Reconnaissance
- Feasibility
- General evaluation
- Limited reevaluation
- General Design Memorandum
- Environmental impact statement
- Special studies

Table 6: Examples of Other Planning Functions

- Master planning
- Military construction
- Mobilization planning
- Logistics planning
- Disaster preparedness & emergency response
- Operations & maintenance budgeting
- Facilities management
- Formerly used defense sites
- Installation restoration program
- Work for others
- Strategic planning
- Special studies

What's a Continuing Authority?

Once all Corps projects required a specific act of Congress to authorize their construction. In other words, if Congress did not specifically mention its desire to construct a project in a piece of legislation it would not be built. Typically, all the projects Congress wanted built were bundled together into an omnibus bill that included all water resource development projects. Initially, flood damage reduction projects were included in Flood Control Acts and navigation projects in Rivers and Harbors Acts. The current omnibus acts are called Water Resource Development Acts (a.k.a., WRDA pronounced "word-uh").

Congress has decided to give the Secretary of the Army the authority to approve and construct certain size and type projects. This can be done on a continuing basis. Thus, we have the so-called continuing authority programs. Congress establishes the type of projects that can be built without specific Congressional authorization in the language that creates the authority. These authorities are generally found in one of the omnibus acts. The size of the projects is established by dollar limits periodically set by Congress.

The number of projects constructed is established through the joint interaction of Congress and the Administration in the budget process. Some Administrations have seen fit to provide higher levels of funding, hence more projects, for the CAP than others. Each continuing authority program has a separate authorization, spending limit, and budget.

it has at any time in the past. In addition to the project purposes shown in Table 4, Corps planners may find themselves involved with water supply studies, reservoir reallocation studies, drought contingency plans, operation and maintenance studies including dredged material plans (both beneficial uses and long-term disposal strategies) and major rehabilitation studies, reservoir master plans, and planning assistance to the states to name some of the more common, newer water resource planning functions. In addition, planning has made significant contributions to other Corps planning functions.

In addition to the formal planning responsibilities Corps personnel encounter many informal planning responsibilities. For convenience, we call planning activities done outside of planning divisions and by people other than planning division personnel informal planning responsibilities. For example, setting budget priorities for the operations and maintenance (O&M) functions of the Corps requires a considerable amount of planning. O&M personnel involved in finding beneficial uses of dredged material also do some planning. Managers at many levels of the Corps' organization are involved in strategic planning. There are many areas in formal and informal responsibilities of the Corps where planning can make a significant contribution to the Corps' missions.

The important point to make here is that no matter whether the planning responsibility is in water resources or other areas, whether it is formal or informal, the Corps' six-step planning process is equally applicable. It is a robust, rational planning

framework that is sufficiently flexible for any and all types of planning encountered by Corps personnel. That is not to suggest that it is or should be pursued with equal resources, detail or rigor in every situation. Budgets, schedules, the significance of the work, knowledge of the planning process and other factors will dictate the extent to which a structured planning process is pursued. The basic approach to problem solving embodied in these steps is, however, sound and proven and can be used in all planning situations.

PLANNERS

Within the Corps, you will find planners and people who plan. A **planner** is "a generalist with a specialty." Planning requires men and women with knowledge, imagination and skills, and a commitment to critically examine and act on objectives concerned with the improvement of the human condition. Planners must respond to complex and interrelated processes of social, economic, cultural, environmental and political change at every scale from the local to the global. Their specialized expertise derives from their ability to relate scientific and technical knowledge to action in the public domain. No one discipline prepares a person to be a planner. *Planning is intrinsically an interdisciplinary process.*

The skills of a planner, which should be considered "in addition to" their specialty skill, are shown in Table 7. The skills, ranked in order based on a somewhat dated (1976) survey of Massachusetts Institute of Technology planning graduates might show a different order today (computer skills would surely rank higher and more communication skills would be prominently ranked), but the array of skills is still relevant.

Planners come from many backgrounds including: urban studies, environmental studies, architecture, political science, engineering, economics, sociology, law, the natural sciences, management, geography, and public administration among others. The Corps' study team would reflect this same mix of skills, adding some particularly useful in water resources problems. The Corps' interdisciplinary study team might include some of the following or other specialties: community planners, resource economists, agricultural economists, regional economists, geographers, sociologists, psychologists, statisticians, computer programmers, information management specialists, outdoor recreation specialists, attorneys, real estate appraisers, public relations specialists, meeting facilitators,

Study Levels

Sometimes you need a lot of information to make a decision and other times you only need a little. There are different levels of detail required for different decisions. We gather less information when buying a candy bar than when we buy a car. The consequences of the decision are substantially different.

Just as the Corps has different project purposes and different types of reports, there are different levels of studies. Since the Water Resources Development Act of 1986 there have been **reconnaissance** and **feasibility** studies. The feasibility study is the more detailed of the two. In reconnaissance efforts there may be less detail or emphasis at some points in the planning process than there would be in a feasibility study but the differences are of degree, not in approach. The Corps' six-step planning process can be used for all types of planning studies at all levels of detail.

illustrators, operations research specialists, landscape architects, architects, civil engineers, mechanical engineers, electrical engineers, cost estimators, hydrologists, hydraulics specialists, geohydrologists, design engineers, soils scientists, surveyors, foundations experts, archaeologists, ecologists, historians, financial analysts, transportation analysts, marine scientists, wildlife biologists, fisheries biologists, botanists, foresters, chemists, water quality analysts, oceanographers, GIS experts, enforcement specialists, project managers, geologists, agronomists, sedimentologists, entomologists and others.

In addition to planners there are the people who plan. These are the specialists who may not recognize the work they do as planning. They may be found in operations and maintenance, engineering, construction divisions, the front office or virtually any other level of the organization. Helping other people who plan to do their job better is one of the greatest values of the Corps' planning process.

Table 7: Planner's Skills

- Writing
- Synthesis
- Interaction
- Consulting
- Research Design
- Community Organizing
- Information Retrieval
- Environmental Programming
- Data Analysis
- Teaching
- Original Information Getting
- Management
- Economic Techniques
- Spatial Design
- Evaluation
- Site Planning
- Computer Skills
- Operations Research
- Recording

WHERE DO PLANS COME FROM?

There comes a time in every planning model when **alternatives** are designed to address the problems that motivated the planning process in the first place. But where do plans come from? Alternatives are solutions to problems that contribute to stated planning objectives. In the Corps' planning process the emphasis shifts to identifying and designing alternatives that solve a problem in step three, **plan formulation**. Thus, plans emerge from the plan formulation process, a subject addressed at length in Chapter Seven. For now, we content ourselves with an overview of where plans come from and how this formulation activity fits into the "big picture".

PROJECT DEVELOPMENT AND PLANNING

It's fair to say that not everything Corps planners do during the course of a day can be called plan formulation or even planning. Thus, we find it necessary to invent terminology that makes distinctions among the types of work Corps planners do. Their *work can be considered one of four different types: project*

development; study management; planning; and, plan formulation as shown in the concentric rings model of Figure 3.

Project Development Process

Planning and plan formulation can be separated from the milieu in which they take place. To facilitate that distinction we define the most inclusive concept to be *project development, i.e., all the activities from initiation of a study through construction*. This is done to allow the separation of the planning process from implementation activities as well as from the institutional setting in which planning is done.

The Corps' way of doing business has evolved over time. This includes the financial, administrative, organization and management styles, and requirements of the agency as well as the multitude of institutional relationships they have developed. Some of this culture is clearly related to the planning process. Other tasks may be necessary to the planning process but they are not part of it.

Study Management

This subset of project development includes all the planning process tasks plus activities that include study management. *Study management activities include* the activities that support the planning process that may not be directly involved with the problem solving aspects of planning. These activities include: *contracting; budget work; inter-agency transfers of funds and personnel; other personnel issues; report preparation, printing, and distribution; shepherding the report through the review process; etc.*

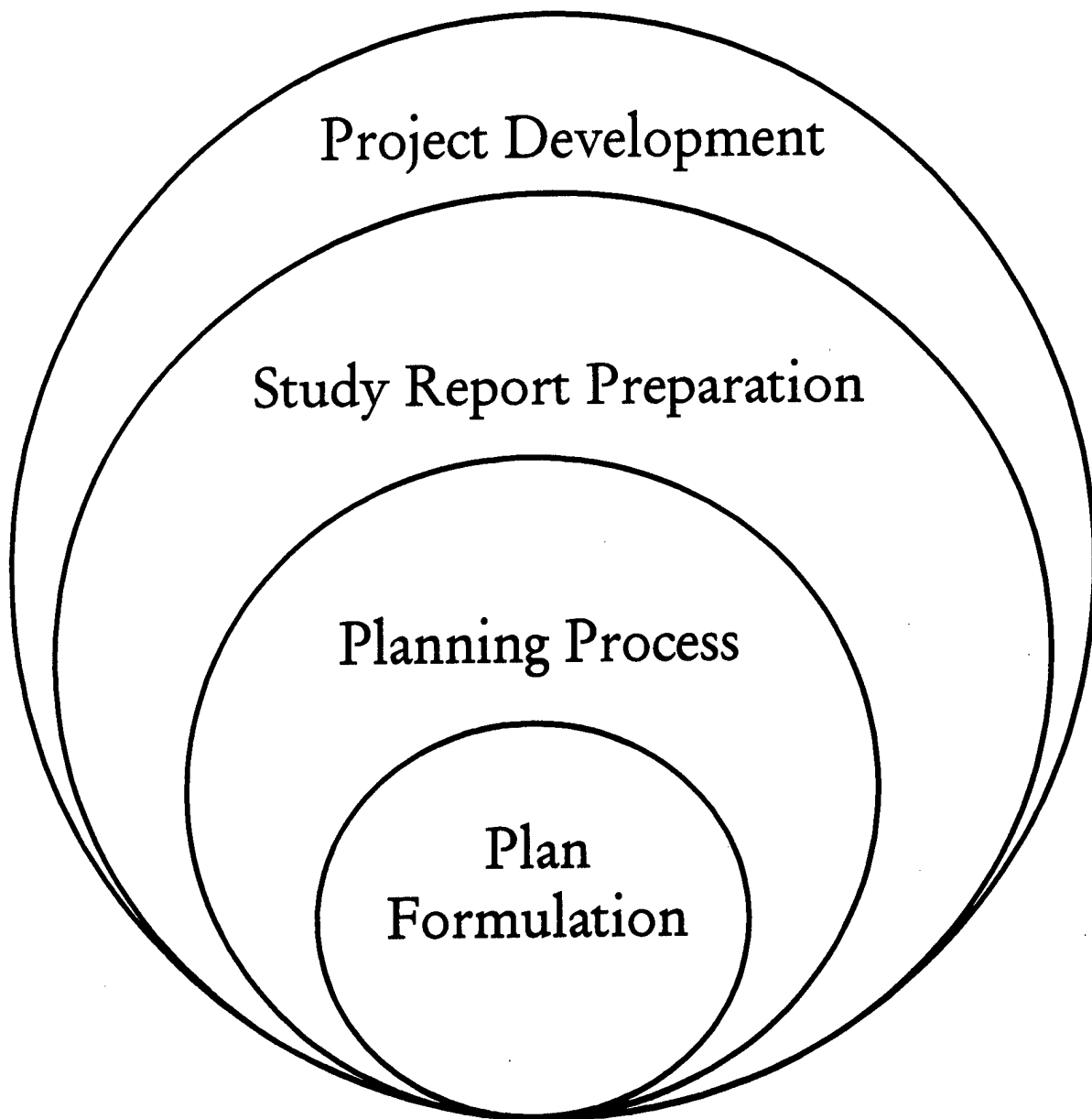
Planning

Planning, of course, comprises all the work associated with the six-step planning process. More details on this are provided in subsequent chapters.

Plan Formulation

This is the point in the planning process "where plans come from". How that bit of magic happens is considered at greater length in Chapter Eight.

Figure 3: Relational Terminology



SUMMARY AND LOOK FORWARD

Planning is what Corps planners do. Planning has been defined here as the deliberate social or organizational activity of developing an optimal strategy for solving problems and achieving a desired set of goals. It will take the remainder of this manual to detail some of the nuances of this process. It is a rational approach to problem solving that employs an iterative six-step process in water resource and other arenas. That detailing begins in the next chapter with brief histories of water resources development in the United States and the evaluation of water resources planning by the U.S. Army Corps of Engineers.

CHAPTER THREE: HISTORY OF WATER RESOURCES PLANNING

"THE PAST IS ONLY THE PRESENT BECOME INVISIBLE AND MUTE; AND BECAUSE IT IS INVISIBLE AND MUTE, ITS MEMORIZED GLANCES AND ITS MURMURS ARE INFINITELY PRECIOUS. WE ARE TOMORROW'S PAST." MARY WEBB(1881-1927) English novelist.

INTRODUCTION

The current water and related land resources planning framework, the Principles and Guidelines (P&G), is not a destination. The P&G is only a way point on a long journey to another place. Time has obscured the point of origin and the paths taken prior to the 1940s to get to where we are today. The ultimate destination cannot be seen from here. We can only see a little way down the path we are on.

The journey/path analogy is an apt one for plan formulation. The framework has evolved gradually, reflecting the changing political and social values of the day. The current P&G have persisted for 12 years at this writing, a modern record for longevity among planning principles as this chapter will reveal.

Table 8: Significant Events in Water Resource Planning

- The first Public Works
- Gallatin Report
- Canal Era
- Reclamation Act
- Conservation Movement
- 308 Reports
- River and Harbor Circular Letters
- 1936 Flood Control Act
- Bureau of Budget Circular A-47
- Green Book
- Senate Document No. 97
- Principles & Standards
- Principles & Guidelines
- WRDA 1986

Knowledge of the historical background of Federal policies for water and related land resource planning is indispensable to an understanding of the present-day situation and its future prospects. In this chapter, we provide a brief review of some events and circumstances of the past 200 years that are still shaping problems and issues in the controversial field of water resource development and, consequently, water resource planning. Table 8 summarizes some of the major events discussed in this chapter. Examined without perspective, current policy may look contradictory, arbitrary and confusing. In historical perspective it makes sense, embodying constitutional traditions, political convictions, institutional developments, and changing national values to be reckoned with now and into the future.

The values of a society are reflected in its public policy goals. Different mixes of values will appear in different historical epochs. As a result, policy goals will shift and evolve over time. Corps' planners recognize the present as a time of significant changes. The advent of changes in the cost-sharing formulas and an expanded role for non-Federal partners befitting their

expanded financial responsibilities marks a serious change in the Corps' planning programs. This is a time of great change.

When we recount the history of the Federal government's role in water resource development and planning, however, we see wave after wave of significant change. Even in relatively stable periods during which "business-as-usual" had enough time to take on meaning, we see the seeds of change sown in the Nation's political and public landscapes. With remarkable regularity these seeds of change would blossom into periods of upheaval and major reorientations in water resource development. Only the passage of time and the change of personnel mask the significance of these upheavals to the programs and those executing them. If nothing else, recent history shows the resiliency of the planning process as it has repeatedly adapted to changing priorities and circumstances.

While there are many excellent, detailed writings on the history of Federal water resource planning,⁵ there are none concisely focused on the evolution of the planning process. There is a great deal of historical and institutional knowledge in danger of being lost in the absence of this work. This chapter does not pretend to be such a work. It is, however, an attempt to document some of the more important events and circumstances in the evolution of Federal water resources planning in the U.S. as related to the greater focus of this planning manual, so that interested students of this subject can begin their own study.

...seeds of change would blossom into periods of upheaval and major reorientations in water resource development.

A BRIEF HISTORY OF WATER RESOURCE PLANNING IN THE U.S.

THE BEGINNINGS OF WATER RESOURCE PLANNING

"At the beginning of human history stands a man with a hoe digging in the soft earth on the banks of a silt-laden river somewhere in Egypt or Mesopotamia...We shall never know the name of the man who built the first irrigation ditch, nor exactly where he built it...Innumerable consequences were to flow from his discovery that he could tame the river or at least imprison part of it and place it at his service. This mastery of water was the beginning of his mastery of the earth." *The Canal Builders*, p. 1.

⁵ Reference to several of these writings can be found in the bibliography of this manual. Nonetheless, two authors merit special recognition. Beatrice Hort Holmes has done an extraordinary job of documenting the history of water resource policy through 1970. The many works of Henry P. Caulfield, Jr. present one of the most thoughtful and farsighted analysis of Federal water policy available in the literature. This chapter owes a great debt to the work of Henry P. Caulfield, Jr. Much of the history of water resource development has been taken directly from his works.

Water resources planning is as old as civilization itself. Navigation began when men learned wood floated. Irrigation accompanied agriculture. Parts of one of the earliest water supply systems, the Roman aqueducts, are still in use.

In the ancient world, civilization began in the river valleys and alluvial fans of the Nile and the "Fertile Crescent" of the Tigris and Euphrates Rivers. Recall your ancient history lessons rich with these names and others like the Tiber, the Aegean, the Indus, the Yellow, the Main, the Danube, the Thames. Water resources made life possible.

*Water resources
planning is as old
as civilization itself.*

Water resource development and the planning that led up to it have a long history. The Nile had been dammed by 3000 B.C. There were water supply and drainage in the Indus Valley (2750 B.C.) and water works in China (2200 B.C.). A canal from the Nile to the Red Sea was built by about 1950 B.C. Hammurabi's water code was completed by 1750 B.C. Water meters were used in Africa over a thousand years before Christ and the first recorded theory of precipitation was formulated about 624 B.C. No less an ancient than Aristotle wrote a book on meteorology and shortly after the birth of Christ, Hero had developed a method for measuring discharge.

Rain gauges were in regular use in China and Korea by the 15th century. DaVinci is another luminary to have written a book about water. During the 17th and 18th centuries some contributions to water resource planning included improvements in the measurement of discharges by Castelli and later Halley; Perrault measured rainfall and evaporation. Bernoulli contributed his equation and piezometer. Woltman developed a current meter and Chezy's formula was completed. In America, Montgotucksee, chief of the Montauk Indians, cut a canal across Long Island from Mecox Bay to Peconic Bay. The early history of water resource planning is clearly preoccupied by understanding the physical systems at work and devising engineering works to harness those systems.

In the history of urbanized society we also see the precursors of planning. The legendary Babylon, for example, bisected by the Euphrates, followed a regular street plan. The temple and tower were at the center and the Hanging Gardens were on the river by the north wall of this protected city. It is in the ancients' planning of cities that modern planning theory is believed to find its roots. Inasmuch as the proximity of water resources often determined the location of cities, water and related land resource planning have been with us, albeit in embryonic form, from the time that humankind left the nomadic life behind. It is quite natural, then, that we consider water and land resources concomitantly.

EARLY WATER RESOURCE DEVELOPMENT IN AMERICA

Look at the largest and oldest cities in the Northeast: Baltimore, Philadelphia, New York, Boston. All are port cities. Find the oldest towns in the

original states and they are generally nestled along the rivers and coasts as ports, mill towns, or fishing villages, all dependent on water.

It is believed that most early water resource development was private and local in nature. In early America, as in many other countries, advances were made in the understanding of hydrology and water resource management. In time, water resource development became more cooperative in nature. Examples of good planning abound, beginning in the mid 18th century. George Washington was named chairman of a group charged with making the Potomac River navigable. A series of five locks was installed to allow barges to pass Great Falls, still a popular outdoor recreation site near Washington, D.C.

WATER RESOURCE DEVELOPMENT IN THE U.S.

The First Public Works

*One of the first acts of the Congress of the newly formed United States was, on August 7, 1789, to authorize construction of a lighthouse at Cape Henry, Virginia. This was the first **public works project** undertaken by the Federal government. It was built in recognition of the fact that coastal and foreign shipping was the lifeblood of the nation's economy. Federal funds were first appropriated for **inland waterways** on April 6, 1802 when Congress granted \$30,000 to repair and erect piers on the Delaware River after the state ceded the land to the government.*

The Gallatin Report

Before the advent of the railroad in the 1820s, water transport on rivers, lakes and canals - although largely undeveloped - was by far the cheapest means of internal bulk transport. After the Louisiana Purchase in 1803, the need for developing water resources for transportation was evident. In our nation's early days the land mass was relatively fixed, labor and capital were limited, the government was just feeling its way, and there was growing public support for uniting the states. The interest in internal improvements was so great that in 1807, the Senate directed Treasury Secretary Albert Gallatin to make a thorough investigation of waterways, canals and roads.

**"Pork Barrel"
politics is
nothing new.**

Apologizing for the "lateness" of his report, Gallatin in 1808 presented a foresighted summary guide to future development of a system of roads and inland water routes which would unite the states and provide access to the interior of the continent. The objectives of the Gallatin report were economic development of the West, political unity, and national defense. Gallatin believed these improvements were of little value unless they were all undertaken at once.

The American System

Senators Henry Clay and John C. Calhoun provided the strongest support for Gallatin's ideas and in 1817 they proposed a seldom mentioned development plan called the "**American System**". The American System was a plan to foster economic self-sufficiency and national unity through a protective tariff and a strong home market.

Inland Waterway Trust Fund

The Inland Waterway Trust Fund was established by the Inland Waterways Revenue Act of 1978 and amended by WRDA 1986. Financed by a tax on fuel used by certain commercial cargo vessels, the fund is used for construction and rehabilitation of navigation projects in the inland waterway.

Once the original colonies were united by transportation routes, they had little incentive to support development of waterways west of the original states. Additional farmers would only increase competition. The American System appealed to eastern interests by protecting them from European imports by means of a tariff. The money raised by the tariff was to be used to develop transportation to the West. This would expand markets for the infant industries in the East and provide better transportation for goods moving to and from the West.

The plan appealed to enough "stakeholders"- industry, pioneers, commerce, and some farmers - to win passage of the "**Bonus Bill**" in 1817, which would have established a permanent fund for internal improvements, sort of a 19th century inland waterway trust fund. President Madison vetoed the bill on the grounds that the commerce clause of the constitution did not cover internal improvements.

The American System is of interest for several reasons. First, it furthered the goal of development of the national economy, a Federal objective that remains with us today. Second, it set strategic precedents within our government institutions. The coalition building to obtain something for almost everyone was a staple of water resource development throughout the nation's history. So-called "pork barrel" politics is nothing new. The perception of pork as something undesirable is, however, a relatively recent development.

The "internal improvements" controversy fairly raged within the Federal government during this time. Eastern farmers tended to oppose development of the West. Others opposed the growth of Federal activity and authority on constitutional grounds. The Whigs disagreed, proposing the American System and it was revived in principle by the Republican Party later in the century.

The Canal Era

In the 17th century Myles Standish (1623) contemplated a canal through the Isthmus of Cape Cod. Augustus Herman contemplated a canal connecting the Chesapeake and Delaware Bays as early as 1680. In 1724 Cadwaller Colden realized a canal could be dug from the Hudson River to Lake Erie. Men dreamed of canals but little came of their dreams. As long as the British were in control of the colonies there was little incentive to dig canals.

George Washington was haunted by these dreams of canals. After a visit to Mohawk Valley he wrote to Chevalier de Castellux at Princeton on October 12, 1783:

“Prompted by these actual observations, I could not help taking a more extensive view of the vast inland navigation of these United States and could not but be struck by the immense extent and importance of it...Would to God we had wisdom enough to improve them.”

Despite the recognized importance of the inland waterways the vast sums of money that would be needed to build the canals prevented their development by the new nation.

The first true canal was completed in 1800 at a cost of over \$1 million. Twenty-two miles long and 35 feet wide, with 12 locks and eight aqueducts, the canal connected the Santee and Cooper Rivers in South Carolina. The age of canal building had begun. “Clinton’s ditch”, also known as the Erie Canal, a 363-mile long, 40 feet wide and four feet deep canal built at a cost of \$7 million, is the best known of the canals.

During the period 1817 to 1838 state and city governments took the lead in the development of inland waterway projects in cooperation with private enterprise. Most of these canals failed to pay back the substantial investments required for their construction, the Erie Canal being a notable exception. State and private enterprise lacked the financial resources and the technical personnel required to make these projects economically viable, despite the fact that the Federal government provided some land grants and army surveying personnel to assist the canal building efforts.

The failures of the great canal era are significant because they opened the door for Federal assumption of inland waterway improvements. Failure of state and private enterprise during the great canal era; the strong belief of the Republican party in the constitutional ability to provide internal improvements; the conviction that inland navigation was critical to the economic development of the West; financial resources made available through import tariffs; and, the available technical skills of the U.S. Army Corps of Engineers - all resulted in Federal assumption of responsibility for planning, financing, construction, operation and maintenance of inland navigation.

The U.S. Army Corps of Engineers

Brigadier General Louis Duportail, Chief Engineer of the Continental Army during the Revolutionary War, requested a corps of engineers to repair damaged works and erect new ones for the conduct of the war. On March 11, 1779 Congress formed the **Corps of Engineers**. This Corps was mustered out of service in 1783 when their job was done.

From 1794 until 1796 some engineering training was provided at West Point. It was not until May 16, 1802, however, that Congress reestablished the Corps of Engineers and constituted the Corps as the Military Academy at West Point. West Point was the first engineering school in the country and the only one until 1824 when Rensselaer Polytechnic was established.

This subtle point is important to the development of water resource programs in the U.S. For many years, Department of War engineers were the only engineers in the country. By the time other schools were established the reputation of the Army engineers was well established. *By virtue of their virtual monopoly on engineering expertise it was natural that when Congress eventually sought engineering capability for waterway improvements they turned to the Corps.*

19th Century Turning Points

There were many milestones in the evolution of water resource development in the U.S. during the 19th century. Crucial to establishing the Federal government's ability to assume responsibility for inland waterway improvements was the 1824 landmark case of **Gibbons vs. Ogden** which gave Congress power over "... navigation within the limits of every state in the union" based on the Supreme Court's interpretation of the Commerce Clause. That same year the first **Rivers and Harbors Act** was passed. It provided for \$75,000 worth of improvements to navigation on the Ohio and Mississippi Rivers.

...support for Federal navigation development grew stronger because of popular disenchantment with railroad rates and discrimination.

Prior to the Civil War, waterway improvements were hampered by controversy over the appropriate role of government in providing internal improvements, sectional jealousies, constitutional questions, and conflicts between the legislative and executive branches. Because of these conflicts, Congress only appropriated small amounts of money for water resource development at scattered sites.

In 1850 Congress appropriated \$50,000 for a study of the best way to prevent inundation of adjacent lands while allowing ships to pass along the Mississippi delta. The **Swamp Acts of 1849 and 1850** turned lands over to the states to be sold with the revenues being used for flood control, drainage and reclamation. In these actions we find the beginnings of a national flood control function, although it was initially linked with navigation.

After the Civil War, support for Federal navigation development grew stronger because of popular disenchantment with railroad rates and discrimination. Waterways were seen as a way to regulate rail rates through competition.

The Windom Select Committee Report on Transportation in 1874 provided, among other things, a plan for waterway development in the 34 states east of the Rockies. The developments were considered in the national interest because they promoted **economic development of the West**. *Economic development of the West has been a recurring theme in water resource development even as the nation's definition of the West was constantly revised and extended westward.*

The Windom Report is interesting because it is basically a compilation of local projects that, in sum, are considered to be in the national interest. The plan, which affected nearly every one of the more populous states, established a water resource legislation tradition of something for everyone, that many in the latter 20th century suggest is wasteful of resources and harmful to the environment.

A catastrophic flood on the Mississippi in 1874 led to a Congressional report and the 1879 establishment of the **Mississippi River Commission (MRC)**. The MRC was empowered to survey the river and prepare plans to improve navigation and prevent floods. Flood control was still tied to navigation improvements. The Corps' first civil **emergency operations** were in response to an 1882 flood on the Mississippi.

In 1878 Major John Wesley Powell issued his "**Report on the Lands of the Arid Region of the United States.**" Powell brought national attention to the technical problems involved in bringing lands into agricultural use through irrigation. The newly created **Geologic Survey** was funded in 1880 to investigate redemption of arid regions of the U.S. by irrigation. The **Carey Act of 1894** was the Federal response to these problems. Under this act, states were granted Federal public lands so they could resell them to private farmers, using the money to assist in the development of irrigation projects.

Beginning in 1879 Congress authorized the Secretary of War to lease **water power** to private companies and to authorize the construction of private power dams. In 1899 Congress required its authorization of all dams in the navigable waters of the U.S. This action was taken to assure the paramount importance of navigation. *Despite the introduction of flood control, drainage, irrigation, and water power as new water development purposes, the century ended as it had begun with navigation for the purpose of uniting the expanding nation for economic development as the major force in water resource development.*

Irrigation the Next Water Resource Purpose

The Reclamation Act of 1902 introduced a new major water resource purpose, irrigation. This act enabled the government to make use of its proprietary powers over public lands in the West to build irrigation reservoirs to supply water for

family farm settlement. Late in the 19th century it had become clear to Congress that in order for the West to be settled, more financial resources than could be raised locally would be required. Large water projects were expensive and required more expertise in planning, development and management than was locally available.

The Townsite Act of 1906 authorized the sale of excess hydroelectric power of **Bureau of Reclamation** projects. The revenues earned from these power sales were used to subsidize and assist irrigators reimbursing the Federal government. These acts as supplemented became key policies in the development of the West.

The Corps of Engineers was directed to complete the **Panama Canal** in 1904. Flood control on the Mississippi River, unrelated to navigation, was acknowledged in its own right for the first time in 1917.

President Theodore Roosevelt on March 14, 1907 established the **Inland Waterways Commission** to prepare a comprehensive plan for improving and controlling the Nation's river systems. Navigation had not lost its preeminent position.

The Conservation Movement

One of the political reactions to the rise of industrialism and large cities after the Civil War was an elite reformist drive favoring government action to "preserve" natural resources. This was encouraged to curb exploitation and dissipation of the national heritage. Underlying this movement were a developing scientific interest in ecology, an appreciation of nature, an ethical concern of the responsibilities of "wise stewardship", and an interest in long-run national strength and survival. In the 1870s and 1880s, states and the Federal government responded by creating reserves and the first National Park in **Yellowstone**.

At the turn of the century natural scientists had become established in some of the new and important Federal government agencies. They and their professional colleagues in academia developed the knowledge of the natural environment which, combined with ethical and aesthetic concerns, provided the intellectual basis for the **Conservation Movement**. The future of the world's energy resources was a particular concern of this movement.

Gifford Pinchot, a conservationist and public official, along with President Theodore Roosevelt formulated a doctrine for this movement that has been frequently quoted as follows: "Conservation is not the locking up of our natural resources; it is their development and wise use." Energy resources could be preserved through the maximum development of water resources for power under this mode of thinking. Pinchot at times expressed the goal of the Conservation Movement as "the greatest good, for the greatest number, for the longest time."

“Development and wise use” may stand as an odd philosophy of conservation today but it was a water resource policy philosophy formulated during the Roosevelt years that prevailed into the 1960s. *The trend toward planning and developing multi-purpose projects fit nicely into the traditions of the 19th century that included: pork barrel politics, nearly semi-annual omnibus bills, an expanding concept of national interest, a rapidly advancing state-of-the-art for engineering and other sciences, a growing base of political and public support, and an intangible sense of adventure in the great engineering projects of that age.* Multi-purpose projects in the early 20th century meant navigation, irrigation, hydroelectric power, water power, and soon, flood control.

...basin flood control evolved from a local concern to a national interest...

Flood Control

Nineteen twenty-seven brought with it the worst flood ever to occur on the Mississippi River to date. The 1927 flood resulted in the **1928 Flood Control Act** in which Congress adopted a project for the control of floods on the Mississippi because of the large local expenditures in the past and the failure of these works to contain the flooding. As the magnitude of the national flood problem grew, and following catastrophic floods in the Susquehanna River in 1936, basin flood control evolved from a local concern to a national interest as expressed in the **Flood Control Act of 1936**. Flood control became a Federal policy with this act.

Many Congressmen who saw navigation improvements as fostering and encouraging the commerce of the nation as a whole, saw flood control on the same rivers as “reclamation of overflow lands for the benefit of private interests.” This private versus national interest controversy was resolved in favor of the national interest as it had been for navigation and irrigation. Like the nation’s navigation program, functional control of the flood control program was given to the Corps of Engineers.

The 308 Reports

The **River and Harbor Act of 1925** authorized the Corps of Engineers to estimate the costs of conducting comprehensive multi-purpose planning studies for all the major river basins of the U.S. That cost estimate was submitted to Congress in **House Document No. 308** in 1926. In the decades that followed, the Corps completed reports on some 200 rivers. *The resulting “308 Reports” were the most complete and comprehensive studies of the river basins of the U.S. ever undertaken to that point in time.*

Although the plans did not set forth recommendations they did include specific plans of improvements and projects. The plans addressed navigation, flood

control, power and irrigation problems and potential throughout the U.S. They were frequently the rallying point for strong regional political interests that often led to the great river basin developments since the 1930s. Many large multi-purpose reservoirs formulated in the 308 reports had been constructed by the onset of the Great Depression. A great many now completed district projects were first conceived of in the 308 Reports.

Construction of public works projects proved a popular policy for overcoming the depression. Where political support coalesced, e.g. the Tennessee or Columbia Rivers, many Federal projects were completed in accordance with the 308 plans. Where regional political support was lacking, e.g. the Connecticut and Potomac Rivers, no development took place despite the availability of both funds and plans. The big dam era kicked off by the 308 Reports continued in many parts of the country until the 1960s.

Continuing Authorities

During the 1940s Congress gave the Corps the **continuing authority** to conduct studies and implement projects for clearing and snagging (**Section 3 of River and Harbor Act of 1945**), emergency bank protection (**Section 14 of Flood Control Act of 1946**), and small flood control projects (**Section 205 of Flood Control Act of 1948**). With these authorities it was no longer necessary for the Corps to receive explicit authorization and appropriations for small scale projects. Also during the 1940s the **Flood Control Act of 1944** authorized the Corps to develop recreation facilities at its projects.

Section 107 of the River and Harbor and Flood Control Act of 1960 established a continuing authority for the construction of small navigation projects. Over the years the annual program and individual project limits for the various continuing authorities have changed with the budget imperatives of the day.

Omnibus Bills

Looking back on the history of water resource development, particularly as it relates to the Corps of Engineers, we see, *beginning with the **River and Harbor Act of 1875**, a series of omnibus bills defining, expanding and changing the Corps' programs, authorities and responsibilities in managing the nation's water resources.* The River and Harbor Acts (RHA) were generally omnibus bills dealing with navigation improvements. The last of 24 River and Harbor Acts was in 1958. Omnibus flood control laws began with the **Flood Control Act of 1917**. The ninth and final Flood Control Act was passed in 1948.

Beginning in 1960 the omnibus bills were combined in a series of five **River and Harbor and Flood Control Acts**. The last act was in 1970. Since that time the omnibus bills have been called **Water Resources Development Acts (WRDA)**. The first was in 1974, the most recent in 1992.

The environmental movement of the 1960s...was built upon...nature preservation principles.

In addition to these omnibus bills there have been many significant pieces of legislation that have affected Corps programs. In 1965 the **Water Resources Planning Act** represented a deliberate effort by Congress to coordinate all Federal water programs through the **Water Resources Council** and to provide a larger role for the states through the establishment of river basin commissions and planning acts to the states. The 1966 **Transportation Act** was the first to ever remove responsibilities or activities from the Corps' program. Title XIII of P.L. 90-448 in 1968 established a **flood insurance** program. A series of environmentally-oriented acts including the **Wild and Scenic Rivers Act** (1968), the **National Environmental Policy Act (NEPA)** (1969), the **Federal Water Pollution Act Amendments** (1972), the **Endangered Species Act** (1973), the **Safe Drinking Water Act** (1974) and others both before and since have had far reaching implications for the Corps program.

The Environmental Movement

The environmental movement of the 1960s through the present was built upon the nature preservation principles that the conservation movement of Pinchot-Roosevelt rejected in favor of multi-purpose project development. The **preservationists**, defeated during the conservation movement, were not often successful politically, but they did not disappear. Preservation interests led to the establishment of Yellowstone as our first National Park in 1872. The **Sierra Club**, which has successfully opposed a number of water resource projects, was founded by John Muir in 1892.

Early in the 20th century, the City of San Francisco proposed to build a dam that would back water into Yosemite National Park. Preservationists and conservationists argued the merits of the dam before Congress. The preservationists lost the great **Hetchy-Hetchy** debate and the project was authorized by the **Raker Act of 1913**. Preservationists had become accustomed to losing such controversies until 1956.

Their first major victory came in the controversy over the proposed authorization of **Echo Park** dam within Dinosaur National Monument. Preservationist opposition resulted in the removal of this dam from the **Colorado River Storage Act of 1956**. This was only the first of many victories to come for the environmental movement.

Environmental interest groups succeeded in having **enhancement measures** added to **mitigation** in the **Fish and Wildlife Coordination Act of 1958**. Rachel Carson, a Federal civil servant, documented ecosystem damage from pesticides in her landmark book *Silent Spring* in 1962. An **Outdoor Recreation Review Commission** was established in 1958 by Congress and its subsequent report led to the addition of **recreation** to water projects. **Water pollution controls** were strengthened by Congress through the late fifties and into the sixties.

Gradually the word "environment" was used officially in policy considerations in place of the earlier "natural resources" which, at the time, implied economic development and use of the resources. At that time "natural" did not seem to encompass the interest in preservation of historic buildings, landscape architecture, job health and safety protection, control of highway billboards, screening of junkyards, anti-littering and other means of enhancing environmental quality.

The animus that seemed to guide the development of the official objective of environmental quality was concern for the aesthetic and the ethical, in the tradition of Emerson, Thoreau and the 19th century Naturalists. Congressional response to the growing concern for environmental quality was positive, strong, and manifest in many acts of Congress, some of which were mentioned in the preceding section.

Henry Caulfield, Jr., one of the great students of water resource development history and himself a major actor in making this history, had this to say about the environmental movement around 1981:

"Scientifically, the ability of natural systems to persist and perform their functions despite inevitable environmental change is said to be related to the complexity of such systems. The more species of plants, animals and microorganisms that have co-evolved to share the energy flowing through an ecosystem, the more stable it is likely to be. Thus, decline in biological diversity is seen as a major source of instability of natural systems that support human life. Decline in diversity is believed to be rapidly occurring, in fact, over major parts of the earth due to the impact of modern civilization.

This decline in diversity is taken to be bad by many who believe that human survival and survival of other endangered species indefinitely into the future is a fundamental value to be strongly fostered politically. Preservation of extensive lightly-exploited natural communities to serve as ecological buffers and reservoirs of diversity (not just national parks and wild areas for human recreation and edification) is seen therefore to be the strategic means, hopefully, for realization of this value.

Environmental survival, intellectually and rhetorically embellished around this basic ecological theme came to dominate motivation in the Environmental Movement of the 1970's."

We find that a fair and foresighted description of the movement with continuing relevance today.

PLANNING PRINCIPLES THROUGH THE YEARS

The Early Years

Missing from our historical overview, thus far, has been an explicit discussion of planning principles. Little is known about the planning principles employed during the first 150 years of our nation's water resource development. The Gallatin Report identified unification of the nation, westward expansion, national defense and economic development as objectives of his ambitious transportation plan. These themes run throughout the decision process of much of the history of water resource development.

Early in this chapter we alluded to the long history of **water resources planning**. For most of our history this planning has been oriented toward understanding the physical and natural systems at work in order to harness or modify them to preserve and enhance human values. As civilizations advance and mature these values change and evolve.

Economic development has always been the major consideration for most water resource development throughout history. The planning process has always been one of more or less sophisticated means of identifying problems and finding solutions.

*...unification of the nation,
westward expansion,
national defense and
economic development as
objectives...*

In the early years problems were perceived as rather obvious and lacking in subtlety: a desire to get from point A to point B by water; a need to keep water from overflowing the town center. Solutions were likewise perceived as obvious and unsubtle: straightened and deepened channels; floodwalls and levees. Problems were often stated in terms of a solution. For example, "the problem is we don't have a levee."

What has changed most about this process is its level of sophistication, made possible by advances in our understanding of the complex natural, environmental, economic, social and political systems involved. The P&G planning framework in use today reflects decades of evolution in thinking about and experience with methods of water resources planning in the United States. It also reflects the current balance of politically determined national values. Though that evolution is far from complete and the framework is far from perfect, it is currently considered better than any other framework available. The P&G planning framework can be better appreciated from a historical perspective.

First Half of the 20th Century

Prior to 1900 and for some years thereafter, investigative, planning, and reporting procedures used by the Corps were largely those developed in consideration of navigation improvements. The **Board of Engineers for Rivers and Harbors** was created by the Act of June 13, 1902. One of its primary functions was to review all examinations and surveys authorized by Congress. The **River and Harbor Act of March 4, 1913** required that reports indicate the scope

of the projects and permit a determination of whether work should be accomplished at Federal expense.

Comprehensive development of water resources first was recognized by the Federal government in 1917 when the flood control activities of the Corps were extended beyond the Mississippi River for the first time. It prescribed that all examinations and surveys for flood control should include a **comprehensive study of the watershed**. This would include water power and "other such uses as may be properly related to or coordinated with the project." Though expanded and revised this remains the basic authority for comprehensive water resource studies for the Corps.

The River and Harbor Act of June 5, 1920 provided that all reports "Shall contain a statement of special or local benefit which will accrue to localities affected by such improvement and statement of general or national benefits, with recommendations as to what local cooperation should be required, if any, on account of such local benefit." The underlying Federal interest in economic development is clearly present.

District offices developed their own methods of engineering

Experience gained and procedures used to prepare some 200 comprehensive 308 Reports were to exert a strong influence over subsequent planning activities of the Corps. An indicator of the nature of the early planning concerns faced by the Corps was the 1928 creation of the **Waterways Experiment Station (WES)**. The Station was created to provide hydraulics and soils engineering data basic to planning. Planning remained very much focused on the engineering aspects of solutions to problems.

River and Harbor Circular Letters

In preparing the 308 reports district offices developed their own methods of engineering and economic analysis. These methods were widely exchanged among the field offices. That experience was reviewed and consolidated by the Chief of Engineers in **River and Harbor Circular Letter No. 39 of June 6, 1936**. This letter prescribed the basic engineering and economic analysis to be required. This guidance was supplemented by additional **Circular Letters** and **Engineer Bulletins**, precursors to the modern ERs, ECs, etc., through the 1940s. The fundamental importance of hydrological studies was recognized in the early guidance as was the need for coordination with other agencies.

One of the first and most significant developments in the articulation of a Federal water resource planning framework occurred with the Flood Control Act of 1936. Section 1 declared flood control to be a proper Federal activity; that improvements for flood control purposes are in the interest of the general welfare; and that *the Federal government should improve or participate in the improvement of*

navigable waters or their tributaries for flood control "if the benefits to whomsoever they may accrue are in excess of the estimated costs, and if the lives and social security of people are otherwise not adversely affected" (49 Stat. 1570, 33 U.S.C. 701a).

In October 1943 President Roosevelt required that project reports be submitted to the **Bureau of the Budget** to assure consistency with the President's program. Efforts to insure uniformity of reports by the various agencies were also undertaken during this time. This marked a significant first step in the development of a formal planning framework.

River and Harbor Circular Letter No. 43 of August 14, 1939 provided instructions on how to analyze the economic justification of flood control projects. Flood control was a new field and there were no textbooks or guidance to follow. Guidelines and procedures had to be established on the basis of field experience with actual investigations. In April 1946, the **Federal Inter-Agency River Basin Committee** established a **Subcommittee on Benefits and Costs** to study the practices of the various water resource agencies. Their goal was to develop mutually acceptable uniform principles and procedures for determining benefits and costs.

Beginning in May 1948 the Chief of Engineers sent senior personnel to the districts to review planning, design and cost estimates, and economics of projects being recommended. During these years acceptable methods of evaluating benefits were under investigation and the Corps was participating in the Subcommittee's activities.

Planning Studies

The actual study process tended to comprise two steps. A **preliminary examination** was done first. "The objective of a preliminary examination is to determine whether existing conditions, facts readily available from reconnaissance, and known data concerning the possibilities of development of a locality warrant expenditure of funds for a survey."⁶ This is clearly akin to the modern reconnaissance study. "Mindful of the need for developing all public opinion" a public hearing was also part of the preliminary examination.

If the preliminary report was favorable it was followed by a more detailed "survey". The **survey report** was to determine:

"the most suitable plan for improvement and whether such improvement is economically justified...If...the improvement appears to be justified, engineering and economic data are

⁶ "Report on the Federal Civil works Program as Administered by the Corps of Engineers U.S. Army: Appendix D Policies and Procedures for Investigating and Planning Civil Works", p. 239. Undated.

developed to the extent necessary for project formulation and evaluation.”⁷

The "Report on the Federal Civil Works Program as Administered by the Corps of Engineers U.S. Army: Appendix D Policies and Procedures for Investigating and Planning Civil Works" describes the "Procedures for Project Formulation and Evaluation" circa the early 1950s. These, in a sense, were the major steps in the planning process. The procedures must: 1) establish the need for the project; 2) select the proper scope, type, and details of design; 3) demonstrate its economic value; and, 4) provide for allocation of costs when a sharing of cost between various interests is involved.

The general principle for plan formulation at the time was:

"Civil Works projects should, therefore, be so designed as to use the least amount of land, labor and materials that will satisfactorily accomplish the desired purposes and the project should not be undertaken unless it can be shown the necessary land, labor and materials would be used more effectively if diverted to the project than they could if the project were not undertaken."⁸

The basic tools of project formulation, analysis of justification and cost allocation were to be estimates of the effects of the projects reduced to some common terms. These effects were called benefits or costs and were measured in monetary terms. *Though a comparison of benefits and costs was required only for flood control projects the Corps applied the benefit-cost analysis test to all its projects.* Thus, economic analysis of projects has been essential to the planning process for well over half a century.

The with and without project condition analysis framework was introduced during this time. At the time, costs other than project costs were deducted from gross project benefits. Project benefits were considered the value of goods and services produced as a result of the project less the value of any resources in excess of project costs. Indirect benefits of the project were not to be considered. The nature of the various project purpose benefits were largely identical to those used today.

With regard to plan selection, Appendix D had the following to say:

"In the final analysis its recommendations regarding projects and plans of improvement present definite economic valuations on a dollar basis; additional intangible values, matters of judgment, and differences of opinion are presented for consideration by Congress

⁷ Ibid, pp. 238-241.

⁸ Ibid, p. 244.

so that the Public Works Committee may have a complete picture of the situation."

Planning had in effect come to mean formulating an engineering solution to an identified problem and establishing its economic justification. The appropriateness of considering other factors seems to be creeping into the planning process with the above quotation. In fact, economic development would remain the major objective for some time to come despite the well intentioned words of the various planning documents.

The **Inter-Agency Committee on Water Resources Subcommittee on Evaluation Standards**, successor to the earlier mentioned Subcommittee on Benefits and Costs, prepared three statements detailing economic practices of the time. They were: "Qualitative Aspects of Benefit-Cost Analysis" (1947); "Measurement Aspects of Benefit-Cost Practices" (1948); and, "Allocation of Costs of Federal Multiple-Purpose Projects" (1949).

The 1950s

Bureau of the Budget Circular A-47

By the middle of the century several familiar elements of the planning process were well established. What was missing was a Federal policy that would assure uniformity of planning among all water resource agencies. There were several agencies involved in water resource development including the Corps, the Bureau of Reclamation and the Soil Conservation Service. In December 1952 the Bureau of the Budget issued Circular A-47 to water resource agency heads to inform them of the standards it intended to use to accept or reject agency evaluations of water resource projects. Circular A-47 incorporated many principles of the Green Book, discussed below.

The Green Book

In 1950 a report of the Subcommittee on Benefits and Costs was circulated among the agencies. This document was revised and published in May 1958 as a comprehensive and objective approach to project formulation and evaluation called "Proposed Practices for Economic Analysis of River Basin Projects". This document came to be known as "**the Green Book**"⁹ like its 1950 predecessor, because of the color of its cover. *The report covers the basic principles and concepts of benefit-cost analysis; principles and procedures for project and program formulation; standards, problems and procedures in benefit and cost measurement; analysis of various project purposes; and, cost allocation.*

⁹ The Green Book was originally issued in 1950 and was revised in 1958. The final, 1958 version is generally what is meant by the Green Book.

The Green Book clearly established the principle of maximizing net benefits. Although the language appears to provide for consideration of "human satisfactions" national economic efficiency remained the preeminent concern.

"The general objective of project formulation is to maximize net economic returns and human satisfactions from the economic resources used in a project."

The major planning steps appear to include an **analysis of needs and available resources** and the consideration of **alternative means** of accomplishing project purposes. Benefits and costs are to be estimated for each project in accordance with Green Book procedures.

The discussion of the formulation process describes a "nucleus of development" that is identified. Then alternative scales of development greater and lesser than the nucleus are considered. The optimum scale is that which maximizes net benefits. The consideration of alternative plans concentrates on assuring that there is no cheaper means of accomplishing the same purpose. It is recognized that "in theory, the broadest range of alternatives...should be considered" but the emphasis is clearly on a severely limited range of objectives.

A project is "...properly formulated and economically justified if: (1) project benefits exceed project costs; (2) each separable segment or purpose provides benefits at least equal to its costs; (3) the scale of development is such as to provide the maximum net benefits; and (4) there are no more economical means of accomplishing the same purpose..." There is no explicit mention of any criteria other than economics.

Though the document was never formally adopted by the Federal Inter-Agency River Basin Committee or its successor many of its principles were embodied in Circular A-47 and others were followed by the water resource agencies. These principles and Circular A-47 were mandating one objective for water resources projects, national economic efficiency. This was contrary to the history of American water resource development which had always included a strong regional economic development component. This and other possible water resource objectives, like unity, national defense, environment, and other human satisfactions, were effectively being denied a role in the planning process.

Plan Formulation in 1959

A statement prepared for the Appropriations Committee of the first session of the 86th Congress entitled "Laws and Procedures Governing Conduct of the Civil Works Program" dated April 1959 contains one of the earliest and most concise descriptions of the planning process. Section IV of this statement describes plan formulation as follows:

"Project formulation is the process of designing water resource improvement projects and programs to serve specific needs efficiently and economically."

The four "principal phases of study" were:

- a. Determination of the nature and scope of the problems for which solution is sought;
- b. Identification of all alternative measures and combinations of measures which reasonably might be applied in the solution of these problems;
- c. Determination of the benefits and costs or, more broadly, the determinate effects, beneficial or adverse, tangible or intangible, of the alternative projects and programs which have been identified; and,
- d. Selection of the best solution from the array of alternative solutions which have been considered.

Formulation is described as from beginning to end largely a matter of weighing and comparing alternatives to determine their relative efficiency in doing the desired water resources improvement job. Subsequent articulations of the planning steps clearly show the debt they owe in spirit to these earlier versions of the plan formulation process.

Senate Document Number 97

President Kennedy, on May 15, 1962, "...approved a statement of policies, standards and procedures to be used...in the formulation, evaluation, and review of plans for the use and development of water and related land resources."¹⁰ This was "Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources" contained in **Senate Document Number 97 (SD 97)**, the name by which these policies are better known.

SD 97 was in response to the President's request for a review of existing standards for formulating and evaluating water resource projects. These changes superseded Circular A-47 (the Green Book was never officially adopted) and were to enable Congress and the President to make informed judgments about the desirability of water projects. The changes, like all the changes before them, reflected the evolving values of the Nation and moved the decision process away from the consideration of a single planning objective.

¹⁰ From a letter dated May 15, 1962 by Director of the Bureau of the Budget, David G. Bell to the heads of all executive agencies, rescinding Circular A-47.

SD 97 identifies three objectives of planning that are each to receive full consideration. They are: 1) **Development**, i.e., national economic development and development of each region within the country (comprising what today would be considered two objectives); 2) **Preservation**, i.e., proper stewardship in the long-term interest of the Nation's natural bounty; and 3) **Well-being of people**. Significantly, the document says "Well-being of all people shall be the overriding determinant in considering the best use of water and related land resources."

For the first time preservation of resources is added as an objective that is distinct from the development of resources. This was a significant step in the evolution of environmental planning objectives that was due to the growing strength of the environmental movement. Also for the first time, policies, procedures and standards for plan formulation were put forth in a single document. It was directed that all viewpoints, national, regional, State, and local, be taken into account, although the national viewpoint is clearly preeminent. **River basins** were to be the preferred planning area and **multi-purpose planning** was to be used.

River basins were to be the preferred planning area...

The standards are significant for the emphasis they placed on specific public values, some for the first time. *So-called redevelopment benefits were legitimized as were outdoor recreation and fish and wildlife enhancement.* The procedure of formulating plans was based on the Green Book criteria described above. However, SD 97 provides for departures from the economically optimum plan to account for intangible impacts. Again, for the first time we can see the explicit introduction of objectives other than economics into the plan formulation and selection process.

Though only an interdepartmental agreement that was never formally approved by Congress, the introduction to SD 97 by Senator Clinton Anderson makes clear the Congressional view on this document:

"The new policies and standards, established in an agreement of the four Department heads, replace Budget Bureau Circular A-47 which caused considerable contention, both as to content and as to the propriety of its source."

This comment makes clear the dissatisfaction that existed with a planning criterion that required the consideration of national economic efficiency only. In a significant contrast with Circular A-47, SD 97 does not require that benefits exceed costs.

In 1964, the National Academy of Sciences commissioned a **Committee on Water**, chaired by Dr. Gilbert White. The Commission included engineers, economists and social scientists. Its job was to appraise the water resources planning process. The Academy Committee's report, "Alternatives in Water Management" was critical of the engineer-oriented actions of prior decades. It recommended a more unified approach to planning that would give social concerns and environmental protection full weight.

In 1968, the Water Resources Council (WRC) proposed a change in the formula for determining the **discount rate**. In partial response to earlier criticisms by academia, environmental interests, and the above Commission, the Water Resources Council proposed a change that would have raised the discount rate, resulting in the justification of fewer projects. Facing congressional opposition, a compromise that resulted in the current interest rate formula was struck. Rates would be based on long-term borrowing rates rather than the coupon rate.

The discount rate controversy was symptomatic of the challenges facing Federal water resource development programs. National values had changed. *The Office of Management and Budget opposed most water projects.* Congressional support was not as strong as it once was. Many of the lobbying groups like the Rivers and Harbors Congress had disappeared. The environmental movement likewise opposed many water projects. The West was largely developed and the nation's most important water needs had been met. Intellectuals in science and academia were criticizing water projects. A national urban majority was not well served by this program. There was a general lack of political support for the programs at all levels of government as their importance waned. On top of all this, states were emerging as a viable alternative manager of water resources in many cases.

Four Accounts

In the 1970 Flood Control Act, Congress identified four equal national objectives for use in water resources development planning. They were: national economic development; regional economic development; environmental quality; and social well-being. During the 1970s two of these, NED and EQ, were actually national objectives. Now only NED remains a national objective. However, these four categories of plan effects remain important considerations of water resource projects.

All significant effects of a plan should be accounted for in the planning process. In order to facilitate an orderly display of project effects it has been suggested they be grouped into one of four accounts. Those effects resulting in changes in national economic development would be included in the NED account, those affecting environmental quality would be in the EQ account, etc. The four accounts remain an effective way to organize and present plan effects for the consideration of decision-makers and the public.

The Water Resources Council began its review of the principles and standards for planning water and related land resources projects mandated by the Water Resources Planning Act of 1965 in 1968 amidst much controversy. In addition to the above considerations, the Council had to respond to the imperatives of NEPA. A Special Task Force to the Council prepared reports on "Principles" and "Standards". A third report on "Procedures" was to be completed later. These two reports known as the Orange Books suggested major changes from the SD 97 planning framework. *Four objectives for planning were proposed. They were: 1) to enhance national economic development; 2) to enhance the quality of the environment; 3) to enhance social well-being; and 4) to enhance regional development. National economic development was no longer to be the preeminent objective.* No one of any of the four objectives was to be more important than any other.

"Principles and Standards"

Section 209 of the Flood Control Act of 1970 expressed Congress' intent that all four objectives be equal. Nonetheless, the Orange Books

were never adopted. Instead, the Water Resources Council in December 1971 issued its own "*Proposed Principles and Standards for Planning Water and Related Land Resources*" (italics added for emphasis). The major changes from the Orange Books were that: 1) social well-being was dropped as an objective; 2) using regional development as an objective in plan formulation would require advance approval; 3) there must be a plan maximizing contributions to national economic development; 4) there must be a plan contributing to environmental quality; and 5) the discount rate would not be that used by OMB.

Two years of extensive review and debate ensued. On September 10, 1973 "Principles and Standards for Planning Water and Related Land Resources" (P&S) were published in the Federal Register, finally replacing SD 97. *The major change in the final P&S was that environmental concerns were placed on an equal basis with national economic development. There were two objectives for water resource planning.* First, to enhance national economic development by increasing the value of the nation's output of goods and services and improving national economic efficiency. Second, to enhance the quality of the environment by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems.

...environmental concerns were placed on an equal basis with national economic development.

In addition to the two objectives, there would be four accounts: national economic development (NED); environmental quality (EQ); regional development (RD); and social well-being (SWB). Plan impacts on the different accounts were to be evaluated and displayed in a system of accounts. The obligation to formulate an EQ plan was eliminated from the final rules. *A six-step planning process was provided.* The major steps of the evolving planning process were: 1) Specify components of the objectives relevant to the planning setting; 2) Evaluate resource capabilities and expected conditions without any plan; 3) Formulate alternative plans to achieve varying levels of contributions to the specified components of the objectives; 4) Analyze the differences among alternative plans which reflect different emphasis among the specified components of the objectives; 5) Review and reconsider, if necessary, the specified components for the planning setting and formulate additional alternative plans as appropriate; and, 6) Select a recommended plan from among the alternative plans based upon an evaluation of the trade-offs between the objectives of national economic development and environmental quality and considering, where appropriate, the effects of the plans on regional development and social well-being.

The P&S defined three levels of planning. Framework studies and assessments (Level A studies) are substantially inventories of resources and of problems and needs. Regional or river basin plans (Level B studies) are of reconnaissance level, are more limited in area and are carried to greater detail than are Level A studies. Level B studies address total needs, resources, and potential for development of water resources of a basin. Implementation studies (Level C

studies) begin with a problem or need that is subsequently met through the project planning process. The P&S for the first time also included a 13-page discussion of the environmental impact statement.

The Carter Administration issued its "Water Policy Initiatives" in 1978, challenging the then-current way of doing business. Proposed changes in cost-sharing formulas also began to be publicly debated. Following a very controversial "Hit List" in which numerous authorized projects in various stages of planning or construction were threatened with being halted, another round of changes in water policy resulted. Chief among these may have been the development of the *Procedures for Evaluation of National Economic Development (NED) Benefits and Costs in Water Resources Planning (Level C) and Proposed Revisions to the Standards for Planning Water and Related Land Resources*. The NED procedures standardized the estimation of benefits and costs for Federal projects for the first time. The P&S were revised effective September 29, 1980.

The language describing the national objectives of planning studies was modified to make the status of the two objectives clearer:

"Two coequal objectives provide the basis for water and related land resources planning. These objectives are protection and enhancement of national economic development (NED) and protection and enhancement of environmental quality (EQ)."

More generally, the language of the P&S was considerably changed with relatively little change in substance.

The six major steps of the revised P&S planning process were essentially the same but they are more clearly described as follows:

- 1) Specification of the water and related land resources problems and opportunities (relevant to the planning setting) associated with the NED and EQ objectives.
- 2) Inventory, forecast, and analysis of water and related land resource conditions within the planning area relevant to the identified problems and opportunities.
- 3) Formulation of alternative plans.
- 4) Evaluation of the effects of the alternative plans.
- 5) Comparison of alternative plans.
- 6) Selection of a recommended plan based upon the comparison of alternative plans.

The revised P&S go on in §711.101(b) to say:

"Plan formulation is a dynamic process with various steps that should be iterated one or more times. This iteration process, which may occur at any step, may sharpen the planning focus or change its emphasis as new data are obtained or as the specification of problems or opportunities changes or becomes more clearly defined."

The new P&S required that alternative plans be formulated in consideration of the four tests of completeness, effectiveness, efficiency, and acceptability. The major changes in the formulation of plans were: the requirement to include a primarily non-structural plan whenever structural projects were considered and the requirement to establish water conservation as a new national priority to be fully integrated into project and program planning. The alternative plans were now to include an NED plan and an EQ plan, a notion proposed by the Orange Books but rejected in the original P&S. Plans were to be formulated without regard to which level of government had the authority to implement them.

The effects of the plans on the four accounts were still to be displayed and traded-off in the selection process. The name of the Social Well-Being account was changed to Other Social Effects (OSE). Environmental planning procedures were formally added at this time as well. Though not actually part of the P&S, a significant addition to planning guidance was the "Environmental Quality Evaluation Procedures for Level C Water Resources Planning: Final Rule" which accompanied the P&S. The relationship between the planning process and the EQ evaluation phases and stages was detailed here.

"Principles and Guidelines"

The new P&S were in effect for about two years. *The Reagan Administration, with its anti-big government philosophy, repealed the Principles and Standards in September 1982, replacing them with proposed "Principles and Guidelines".* The new, less binding Principles were approved by the President in February, 1983 and the new Standards and Procedures were approved March 10, 1983 in the "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies" better known as Principles and Guidelines or P&G.

The only required plan was the NED plan.

The "Principles" changed the focus from two coequal national objectives back to a single Federal objective. "The Federal objective of water and related land resources project planning is to contribute to national economic development consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements." The only required plan was the NED plan.

The only change in the major steps of the planning process in the P&G was a minor modification of the first step, shown below with the changes italicized:

- 1) Specification of the water and related land resources problems and opportunities (relevant to the planning setting) associated with the *Federal objective and specific State and local concerns*.

The intent of the P&G was clearly to give economic development a higher standing than environmental quality as a criteria for Federal water project planning. The requirements to formulate EQ and nonstructural plans were eliminated.

The new guidelines make mandatory only the NED account. The other three accounts are to be used when they contain information that may bear on the decision-making process. They are no longer required in the sense they once were. The detailed procedures for evaluation of NED benefits and costs, published by the Carter Administration in 1979 as rules, were included in the P&G as administrative guidelines. The EQ evaluation procedures of 1980 were also included in the P&G.

The major change with the P&G was to focus on a single economic development objective. Some had argued that multi-objective planning had become too time consuming, complicated and costly. Environmental groups objected vigorously to the elimination of an EQ objective. Many considered this in conflict with the expressed intent of the National Environmental Policy Act. Also significant was the downgrading of this material from rules to guidelines. Changes to the Guidelines can be made by agency heads if they have the approval of the Cabinet Council on Natural Resources and the Environment.

WRDA 1986

The Water Resources Act of 1986 (WRDA'86), Public Law 99-662, was one of the most significant pieces of water resources legislation in recent history. It marked the first omnibus water act in a decade, a decade in which many policy changes had taken place. Section 101 of the Act established new project cost-sharing percentages that required non-Federal interest to contribute a greater share of project costs than they had been accustomed to in the past. Section 105 required non-Federal interests to contribute 50% of feasibility study costs. The cumulative effect of raising the costs of Federal projects in these ways is believed to have been to reduce the demand for Federal projects as well as to increase the role of the non-Federal partner in the study process.

Among the other significant impacts of this law were the creation of an Inland Waterways Users Board to direct the expenditure of Inland Waterways Trust Fund expenditures; the authorization of fish and wildlife enhancement; legislation of the assumption that the benefits of environmental measures at least equal the costs of creating them; and, the establishment of a continuing authority program to modify projects to improve the environment.

Subsequent WRDA's have continued the evolution of Federal water resources development policy. None have had the same impact as WRDA'86, however.

CONTINUING EVOLUTION

The Corps' water resource programs continue to be revised - expanding in some areas, contracting in others - by Water Resource Development Acts and a planning process that continues to develop. Increased cost-sharing responsibilities for the non-Federal partner (WRDA'86) highlight the need to quantify and assess the importance of regional and local economic impacts of plans. These are of far more importance to local partners than are NED benefits. Burgeoning interest in environmental investments, ecosystem restoration (WRDA'86), and environmental impacts argue for an enhanced role for environmental quality.

Some would suggest that the P&G are ill-suited to meet water planning needs today. History has shown the opposite. Despite the swing to and from emphasis on NED only the planning process itself and the four-account framework remain remarkably robust and resilient. An iterative six-step planning process that assesses plan impacts in a four account framework offers planners an organized, comprehensive and rational approach to assessing and evaluating plans.

RECOMMENDATIONS FOR FURTHER READING

The reader interested in the historical background of water resource development in the U.S. has many options. The single best source for comprehensive detail are the works of Beatrice Holmes, a former Department of Agriculture employee. The shame is that she did not continue her work beyond 1970.

Holmes, Beatrice Hart. *A History of Federal Water Resource Programs, 1800-1960*. Washington, D.C.: U.S. Government Printing Office.

Holmes, Beatrice Hart. *History of Federal Water Resource Programs and Policies, 1961-1970*. Washington, D.C.: U.S. Government Printing Office, 1979.

One of the best sources for insight and understanding of the underlying historical and political themes are the works of Henry P. Caulfield. His works tend to papers that can be a little difficult to find without the assistance of a good interlibrary loan librarian to help you. A few suggestions follow, but you'll be rewarded by any of his works. The following works were used extensively in this chapter.

Caulfield, Henry P., Jr. "History of U.S. Water Policy." Colorado Agribusiness Roundup. Fall/Winter 1980-1981. Colorado State University. 1981.

Caulfield, Henry P., Jr. "Let's Dismantle (largely but not Fully) the Federal Water Resource Development Establishment, or the Apostasy of a Longstanding Water Resource Development Federalist." Denver Journal of International Law in Policy. Volume 6. Special Issue 1976.

Caulfield, Henry P., Jr. "The Living Past in Federal Power Policy." Resources for the Future 1959 Annual Report. Washington, D.C. 1959.

Caulfield, Henry P., Jr. "Perspectives on Instream Flow Needs." Paper delivered at Instream Flow Needs Conference. Boise, Idaho. May 4, 1976.

Caulfield, Henry P., Jr. "Planning Programs and Water Problems: Do They Match?" Paper delivered at 1977 National Conference on Water. St. Louis, Missouri. May 24, 1977.

The most serious students will want to make use of the extensive public record. Committee reports on the major legislative actions can be revealing sources of information obscured from the public eye by time or the rigidity of the act's language. Likewise, testimony before the committees considering the acts can be rich sources of information. Want a glimpse behind the scenes? Only the most serious students will want to review the one-of-a-kind documents of the Rivers and Harbors Congress, now part of the library collections of Tulane University in New Orleans.

The evolution of the P&S and P&G is well documented in a series of documents available from the National Technical Information Service (NTIS), U.S. Department of Commerce. The working files of the Water Resources Council are another source of valuable information. Some documents of possible interest are listed below with their NTIS order numbers.

The "Green Book" of 1958. Order # PB-209 180.

Senate Document Number 97. Order # PB-209 171.

Report to the Water Resources Council by the Special Task Force, Procedures for Evaluation of Water and Related Land Resource Projects, June 1969 ("Blue Book"). Order # PB-209 171.

Summary: Federal Agency Technical Comments on the Special Task Force Report Entitled "Projects for Evaluation of Water and Related Land Resource Projects," July 1970. ("T.F. Report" - Vol. I). Order # PB-209 172.

Summary and Index: Public Response to the Special Task Force Report entitled "Projects for Evaluation of Water and Related Land Resource Projects," July 1970. ("T.F. Report" - Vol. II). Order # PB-209 173.

Report to the Water Resources Council by the Special Task Force: Findings and Recommendations, July 1970. ("T.F. Report" - Vol. III). Order # PB-209 174.

Report to the Water Resources Council by the Special Task Force: Principles for Planning Water and Land Resources, July 1970. ("T.F. Report" - Vol. IV). Order # PB-209 175.

Report to the Water Resources Council by the Special Task Force: Standards for Planning Water and Land Resources, July 1970. ("T.F. Report" - Vol. V). Order # PB-209 176.

Report to the Water Resources Council by the Special Task Force: A Summary Analysis of Nineteen Tests of Proposed Evaluation Procedures on Selected Water and Land Resource Projects, July 1970. ("T.F. Report" - Vol. VI). Order # PB-209 177.

Interested in a history of the agency? Many of the districts have commissioned their own histories. A nice history of the Corps has also been prepared. But, if you read the official history you owe it to yourself to read the Maass book which is another view of the Corps, a scathing one that must be read by any serious student of history.

Maass, Arthur. *Muddy Waters*. Cambridge: Harvard University Press, 1951.

U.S. Army Corps of Engineers. *The History of the US Army Corps of Engineers*. EP 360-1-21. Washington, D.C. January 1986.

A somewhat prophetic study is a study published by Colorado State University. It provides some statistical analysis of then-developing trends in the Corps' program.

Yoe, Charles. *The Declining Role of the U.S. Army Corps of Engineers in the Development of the Nation's Water Resources*. Colorado Water Resources Research Institute, Fort Collins. 1981.

To round out your reading list with a few more current titles you might find some of the following of interest.

Arnold, Joseph L. *The Evolution of the 1936 Flood Control Act*. Office of History, U.S. Army Corps of Engineers, Fort Belvoir, Virginia. 1988.

Moore, Jamie W. And Dorothy P. Moore. *The Army Corps of Engineers and the Evolution of Federal Flood Plain Management Policy*. Institute of Behavioral Science, University of Colorado. 1989.

Reuss, Martin. *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986*. U.S. Army Corps of Engineers, Institute for Water Resources. IWR Policy Study 91-PS-1. October 1991.

Rosen, Howard and Martin Reuss, eds. *The Flood Control Challenge: Past, Present, and Future*. Proceedings of a National Symposium, New Orleans, Louisiana, September 26, 1986.

National Academy of Sciences. "Alternatives in Water Management." National Research Council, Washington, D.C. 1966.

SUMMARY AND LOOK FORWARD

This chapter provides an overview of water resource development and planning in the United States over two centuries. It describes in general terms how the planning process evolved to the current Principles and Guidelines. The next chapter picks up where this one has left off and goes on to describe in a bit more detail the current state of planning guidance.

CHAPTER FOUR: PLANNING GUIDANCE

**"If you obey all the rules you miss all the fun." KATHARINE HEPBURN
(1909-) AMERICAN ACTRESS.**

INTRODUCTION

The Corps' planning guidance comes from different places. National policy is expressed by the Congress and the Administration in legislation, Federal rules and regulations, and Executive Orders as well as in the Principles and Guidelines. The Corps itself has generated a great deal of guidance in the form of engineering regulations, circulars, etc. Though only the planning guidance is of interest here, the Corps is subject to guidance that covers a wide variety of topics and functions.

The Corps of Engineers' planning guidance can be found in five primary sources. The first and more important of these is the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*, also known as the Principles and Guidelines or the P&G. The second most important source is Engineering Regulation 1105-2-100 *Guidance for Conducting Civil works Planning Studies*. In no particular order the remaining sources of information are: the *Digest of Water Resources Policies and Authorities*; the Policy Guidance Letters (PGL) series; and, a series of engineering regulations (ERs) and engineering circulars (ECs) in addition to ER 1105-2-100.

Planning policy and guidance are dynamic things. If past is prologue to the future, the previous chapter would suggest that sooner or later the P&G will be changed in another evolutionary leap forward. Policy will likewise continue to evolve as national priorities change. As a result, *it's not possible to provide you with a timeless and unchanging handbook to planning guidance.* Though current at the time of this writing, the materials discussed in this chapter are subject to regular revision and change.

To function effectively as a planner one must read these documents and have a working knowledge and understanding of their contents. Those who would like to understand what Corps planners do would be well advised to browse through the P&G and ER 1105-2-100.

This chapter reproduces the Principles of water resources planning and presents an overview and introduction to other selected planning documents. The original documents should be consulted for a more detailed explanation of the topics found in this chapter. Appendix II contains selected references to planning policy.

THE PRINCIPLES AND GUIDELINES

The P&G is currently the Corps planner's bible. It is the philosophical source document. The P&G were established March 10, 1983. A brief history of the development of the P&G was provided in Chapter Three. The most significant aspects of their passage are as follows: 1) They marked a departure from the Principles and Standards' reliance on multi-objective planning; 2) They established national economic development as the one and only Federal objective for water resources planning; and 3) The P&G were intended to serve as guidance that is recommended, rather than as rules that are required. The structure of the P&G is shown in Table 9.

PRINCIPLES

The Principles comprise a two-page statement that ensures proper and consistent planning by Federal agencies that formulate and evaluate water resource implementation studies. Because they represent a philosophical statement for Federal agency planning they are presented in their entirety at the beginning of this manual.

Table 9: Content of P&G

- Principles
 - 13 principles
- Guidelines
 - Chapter I - Standards
 - Chapter II - National Economic Development Benefit Evaluation Procedures
 - Chapter III - Environmental Quality Evaluation Procedures

Perhaps the most important thing to understand in the Principles is the so-called "NED objective". Non-Federal partners are frequently perplexed by an objective that requires them to consider economic impacts of limited interest to them while denying them equal consideration of more relevant economic impacts (regional economic development (RED) impacts). That is just one of the costs of obtaining a Federal subsidy for what are often local or regional projects. The Principles establish national economic development as the sole Federal planning objective, subject to environmental constraints, and require identification of an NED plan.

GUIDELINES

Table 9 also shows the structure of the Guidelines. Each of the three components is discussed in turn.

STANDARDS

The Standards establish the criteria upon which plans will be formulated, evaluated and weighed and are shown in Table 10. They establish the basic process

for Federal agencies to follow in their planning activities. The six-step planning process is presented in this section of the P&G. Many of the principles identified in the two pages of the Principles are explained in more detail in the Standards. The four accounts are addressed at some length.

Significantly, paragraph 1.1.1(c) clearly provides for departures from the P&G. Though such departures have not been commonplace, departures from the P&G have been clearly and purposely provided for. Departures must be recommended by ASA(CW) and subsequently approved by the Water Resources Council. An example of a departure from the P&G is the Corps' current practice of recommending a locally preferred plan rather than the NED plan.

Table 10: Selected Standards

- Introduction
- The Federal Objective
- Summary of the Planning Process
- General Planning Considerations
- Inventory and Forecast of Conditions Without a Plan
- Alternative Plans
- Accounts
- Displays
- Cost Allocation
- Plan Selection
- Risk and Uncertainty

NED BENEFIT EVALUATION PROCEDURES

The general approach to NED benefit evaluation is to estimate changes in national economic development that occur as a result of differences in project outputs with a plan as opposed to national economic development without a plan. Only project-related changes in levels of national economic development are estimated. These values are to be expressed in average annual equivalent dollars. Specific procedures have been developed to estimate the NED value of outputs from a variety of project outputs as shown in Table 11.

Table 11: NED Benefit Evaluation

1. M&I Water Supply
2. Agriculture
3. Urban Flood Damages
4. Hydropower
5. Inland Navigation
6. Deep Draft Navigation
7. Recreation
8. Commercial Fishing
9. Other Direct Benefits
10. Unemployed or Under-employed Labor Resources
11. NED Costs

Chapter II of the Guidelines presents detailed procedures for estimating national economic development benefits for most of the Corps' water resource planning purposes like flood damages, navigation, hydropower, etc. Most of these benefit procedures have been supplemented by a series of National Economic Development Procedures Manuals produced by the U.S. Army Corps of Engineers' Institute for Water Resources. Thus, anyone interested in how the Corps of Engineers estimates benefits for its traditional planning projects should begin by consulting the procedures in the P&G. For more detailed explanations and examples the procedures manuals are the next logical step. A list of procedures manuals is provided in Appendix II on planning policy.

NED benefit estimating procedures have not been developed for environmental project outputs at this time. Hence, NED evaluations are often restricted to the cost side of the project as is the case with incremental cost analysis procedures used for mitigation and restoration projects.

EQ EVALUATION PROCEDURES

An often overlooked part of the P&G is Chapter III which presents environmental quality procedures. The definitions, general evaluation requirements and processes of this chapter provide the basis for environmental impact statement and assessment analyses at which the Corps has become so proficient.

The EQ evaluation process has a slightly different orientation than the six-step planning process. Its purpose is not to identify plans that meet planning objectives. Rather, *EQ evaluation is used to identify significant beneficial and adverse effects of alternative plans that do result from the six-step planning process on significant EQ resources.* Just as the NED benefit evaluation procedures are used in the planning process, so to the EQ evaluation process is used.

The EQ evaluation process proceeds in the four phases and ten activities shown in Table 12. Phases are shown at the first level of detail, activities at the second.

Table 12: EQ Evaluation Process: Phases and Activities

Phases	Activities
Define resources	Identify resources Develop evaluation framework
Inventory resources	Survey existing conditions Forecast without-plans condition Forecast with-plan condition
Assess effects	Identify effects Describe effects Determine significant effects
Appraise effects	Appraise significant effects Judge net EQ effects

ER 1105-2-100 PLANNING GUIDANCE

Formerly, planning guidance was provided in a series of engineering regulations (ER). Now, all of that planning guidance has been collected and is presented in ER 1105-2-100 *Guidance for Conducting Civil Works Planning Studies*. The ER is alternately known as ER 100, the Planning Guidance Notebook, or PGN (pronounced pigeon). The contents of the 28 December 1990 version of the ER are summarized in Table 13.

This ER provides guidance that is specific to the Corps' conduct of planning studies. In essence, it puts the Corps' spin on the P&G, fleshes the P&G out and fills the voids the P&G fail to address. The first task of any new planner should be to read this regulation from cover-to-cover. How can we recommend this over the P&G? Not to worry, the P&G comprise most of Chapters 5, 6, and 7 of the ER, items 5, 6, and 7 in Table 13.

Table 13: Content of ER 1105-2-100

1. Introduction
2. Planning Programs
3. Continuing Authorities Program
4. Project Purposes
5. Planning Principles
6. Economic Considerations
7. Environmental Planning & Evaluation Considerations
8. Washington Level Review
9. Seventeen Topical Appendices

Chapter 2 of the ER provides the best summary of the types of studies, reports and study procedures available. **Planning assistance to the states** as well as other planning assistance is also described. Chapter 2 is recommended reading for anyone who will be intimately involved in the Corps' planning study process.

The third chapter of the ER describes the Corps' **continuing authority programs** (CAP). The CAP are a set of legislative authorities that allows the Secretary of the Army acting through the Chief of Engineers to plan, design and construct certain projects without specific Congressional authorization. These CAP projects are smaller scale, limited scope, single purpose projects with periodically adjusted Federal funding limits. Chapter 3 is recommended reading for anyone pursuing a project through one of the Corps' continuing authority programs.

Chapter 4 of the ER provides a detailed introduction to important aspects of the Corps' traditional project purposes. Important terminology and policy issues are presented in this chapter. It is recommended reading for anyone involved in a traditional Corps study.

Chapters 5, 6, and 7 basically present the P&G. The chapters begin with a verbatim reproduction of part of the P&G. The ends of each chapter add relevant additional material to the P&G Standards (in Chapter 5, beginning on p. 5-34), P&G Evaluation Procedures (in Chapter 6, beginning on p. 6-141), and

Environmental Evaluation (in Chapter 7, beginning on p. 7-37). The report submittal, assessment and processing procedures of the Corps are described in Chapter 8, Washington Level Review. A set of 17 appendices provide technical details on a number of subjects, sample documents and examples.

ER 1105-2-100 is a lengthy document. It is not a compendium of all planning guidance, however. Additional materials can be found in a series of related ER's and other Corps guidance. Nonetheless, it is *the best single source of planning guidance*. Though it is updated periodically, updating is a major undertaking and it is not done on a routine basis. Thus, it may be necessary to look to other sources for the most up-to-date policy.

POLICY GUIDANCE LETTERS

At this writing there is a series of 44 Policy Guidance Letters (PGL). *The PGLs are an effective vehicle for providing guidance on issues needing clarification or changing priorities*. They are an important source of information that Corps planners should not overlook. They are generally of little interest to the general public. Though they can be topical and up-to-date the downside to these letters is that they are so numerous. It can be difficult to stay current with such voluminous ad hoc guidance.

POLICY DIGEST

The Digest of Water Resources Policies and Authorities is a periodically updated compilation of existing administrative and legislative water resources policies and authorities pertinent to the Civil Works activities of the Corps of Engineers. The most recent version of the digest at the time of this writing was dated 15 February 1989. The reader must beware that as the digest becomes more dated it will contain no information about more recent initiatives. Insofar as more recent initiatives are the ones planners most need information about, the digest may be of limited use in describing the most recent policy initiatives.

In 29 chapters the 1989 Digest provides a comprehensive overview of policy considerations, as opposed to the planning or procedural considerations. This is a technical and detailed document that is very faithful to the legislative and administrative history of the Corps' activities.

OTHER CORPS GUIDANCE

It's difficult to stay abreast of Corps policy because it is contained in so many documents. If you want to be familiar with the Corps' guidance, read the

Table 14: Corps Guidance

AR	Army Regulation
EC	Engineer Circular
EM	Engineer Manual
EP	Engineer Pamphlet
ER	Engineer Regulation
OM	Office Memorandum (OM)
TL	Technical Letter
1105	Planning
1110	Engineering
1120	Construction - Operations
1130	Construction - Operations
1140	Construction - Operations
1165	Policy

materials referenced above. Once you have done that, you are ready to tackle the Army regulations (AR's), engineering regulations, engineering circulars (EC's), engineering pamphlets (EP's), engineering technical letters (ETL's), Executive Orders (EO's), and office memorandums (OM) and budget guidance that have accumulated over the years. Table 14 provides a guide to the content of the various types of guidance. The guidance identification system begins with the type of guidance, AR, ER, EC, EP, etc. followed by a four digit number from Table 14 that indicates the subject of the guidance.

There is an Index of Regulations that has been prepared from time-to-time. It varies from up-to-date to obsolete in terms of

its value. Though it is a logical place to start, it must be used with caution if it is not current.

Another important source of guidance is the annual budget guidance found in the *Annual Program and Budget Request for Civil Works Activities Corps of Engineers, Fiscal Year 199X*. Additional guidance helpful in the planning process can be found piecemeal in the ER's and EC's of Corps functions other than planning.

SUMMARY AND LOOK FORWARD

To understand the Corps' planning process read ER 1105-2-100. If you want to be an expert on the Corps' planning process read all the materials mentioned in this chapter then go do planning for a few decades. How do you do planning? That question is addressed, notice we did not say answered, in the next seven chapters that describe a couple of characteristics of the Corps' planning process and its six steps. We begin with a consideration of two very important and somewhat unique characteristics that pervade the Corps' planning process, iterations and screening.

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CHAPTER FIVE: CHARACTERISTICS OF THE CORPS PLANNING PROCESS

"THAT AMAZING AMERICAN PHENOMENON, THE PORK BARREL, EMERGED IN COMPLETE AND FUNCTIONING ORDER FROM THE TEEMING CORPS OF ARMY ENGINEERS. THE THEORY BEHIND IT IS THAT THE HARDER THE PEOPLE SCRATCH TO PAY THEIR TAXES THE MORE MONEY THERE WILL BE FOR THE CORPS OF ARMY ENGINEERS TO SCRATCH OUT OF THE TREASURY WITH THE AID OF CONGRESS IN ORDER TO MAINTAIN ITS CONTROL OF THAT BODY BY BUILDING OR PROMISING TO BUILD, MORE OR LESS JUSTIFIABLE OR DOWNRIGHT UNJUSTIFIABLE PROJECTS IN THE VARIOUS STATES TO EARN CREDIT DURING THE NEXT ELECTION CAMPAIGN." HAROLD ICKES FOREWORD TO ARTHUR MAASS' *Muddy WATERS*.

INTRODUCTION

Each of the next six chapters addresses one of the six planning steps. Though the sequence of presentation is a simple linear progression the practice of planning is anything but. In fact there are at least three characteristics of the Corps planning process important enough to warrant consideration in this chapter, though all were introduced in Chapter Two. They are: scoping, iterations and screening. Scoping is conducted primarily in the early stages of the planning study. Iterations and screening overlay and run throughout the entire planning process. Each is addressed in turn below.

How Do You Scope?

There are no immutable rules for scoping. It, like much of planning, is a blend of experience, professional judgment, intuition, and luck. You might begin by limiting yourself to those things you can do something about. Authorities, budget priorities, the interests of the non-Federal partner and the public can help you focus the study effort. For example, there is no reason for the Corps of Engineers to try to address the education problems of an area, there is nothing they can do about it. The basic approach then, is to eliminate the obvious, concentrate on the important elements and sweat over where and how you draw the line between the two.

SCOPING

Continuing with our definition by analogy consider one more. Intuitively, in getting from point A to point B in the study process, we may have a virtually unlimited number of paths we might travel. The scoping process is akin to standing on the highest ground available and looking as far down as many paths as possible to see which paths appear most promising. Based on our best judgments with the available data we walk down the most promising paths until: we reach our destination; we realize we've made a mistake; or, we come to a fork in the path at which time we again look as far down each path as we can and make a new choice. Scoping is

getting the general lay of the land, absent all the relevant information, and deciding how to initially proceed.

As a study begins all problems are potential candidates for study. All data are available for collection, analysis and consideration. There are an infinite number of variables that can be measured and forecast to describe existing conditions and futures without and with projects. Potential measures are unlimited and the alternatives that can be imagined from them become virtually infinite in number. The effects that can be evaluated and the comparisons of them grow exponentially. The task before the planner becomes like an infinite horizon, full of indistinguishable details.

Scoping is needed to begin the planning process. It determines the range of operation and should be done for all aspects of the study. Scoping is like picking up the binoculars and training them on the horizon in search of the important details, bringing them into focus. It identifies those things that need to be considered and eliminates what will not be considered. Virtually any task in the planning process can and should be scoped. What problems and opportunities will be addressed? What data will we collect? How will we analyze it? How many futures will be described? What measures can we ignore? These are but a few of the questions that can be answered by the scoping process.

The scoping process is an ongoing one. At the start of a study, scoping is used to begin to zero in on problems, opportunities, and measures the study can address. It's an attempt to survey the landscape and ask, "What's important here?"

The scoping process is an ongoing one.

Whom should we be talking to, what data should we start collecting?" Later it may become a process in which the study team decides how much detail to go into in the development of the various future scenarios or alternative plans. The purposes of the scoping process will change throughout the study. The need for a scoping process is constant throughout.

Scoping is essential from the very start of the study process. It is not a foolproof process, however. Just as the binoculars narrow your field of vision and increase the possibility that you may be missing an important detail, so does scoping. Nonetheless, scoping is necessary to get a study underway. Deciding what is and what is not important is an essential first step. When mistakes in judgment are made in the scoping process they are simply corrected later. As long as the planner is not afraid to say, "We made a mistake and should have considered...", the scoping process will be an invaluable aid in focusing study efforts on what is most important.

THE NEPA/P&G SCOPING PROCESS

The description of the scoping process offered above is an intuitive, common sense one. There are more formal ones. *First, there's the NEPA scoping*

process. It applies primarily to the preparation of environmental assessments and environmental impact statements described in the Council on Environmental Quality's National Environmental Protection Act regulations (40 CFR Parts 1500-1508). See the accompanying side bar.

NEPA Scoping Process

Section 1501.7 of the Council on Environmental Quality's NEPA regulations describes the tasks of the scoping process beginning at paragraph (a).

(a) As part of the scoping process the lead agency shall:

(1) Invite the participation of affected Federal, State, and local agencies, any affected Indian tribe, the proponent of the action, and other interested persons (including those who might not be in accord with the action on environmental ground), unless there is a limited exception under §1506.6.

(2) Determine the scope (§1508.25) and the significant issues to be analyzed in depth in the environmental impact statement.

(3) Identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (§1506.3) narrowing the discussion of these issues in the statement to a brief presentation of why they will not have a significant effect on the human environment or providing a reference to their coverage elsewhere.

(4) Allocate assignments for preparation of the environmental impact statement among the lead and cooperating agencies, with the lead agency retaining responsibility for the statement.

(5) Indicate any public environmental assessments and other environmental impact statements which are being or will be prepared that are related to but are not part of the scope of the impact statement under consideration.

(6) Identify other environmental review and consultation requirements so the lead and cooperating agencies may prepare other required analyses and studies concurrently with, and integrated with, the environmental impact statement as provided in §1502.25.

(7) Indicate the relationship between the timing of the preparation of environmental analyses and the agency's tentative planning and decision-making schedule.

A scoping process applicable to any planning study is summarized in the P&G (Paragraph 1.4.8 Scoping). This scoping process comprises seven tasks which, though numbered for identification, are not necessarily sequential. First, the agency should determine the extent to which the likely significant issues will be analyzed. Do you have the time, money and personnel to remove all uncertainty about each issue? Can you do that for any issue? If so, which issues are most important? If not, how far must your analysis go before you feel comfortable with your decision?

Second, the planning team should define the planning area as well as possible. Until the problems and plans have been fully analyzed it may not be possible to precisely define the planning area. Nonetheless, we must begin with some assumptions. It is at this point that natural, political, economic or social boundaries may serve as starting point assumptions about the study area. Additional information may necessitate a subsequent redefining of the planning area.

The third task is to identify and eliminate any issues that are not significant or that have been adequately addressed in other studies. In a world of limited resources no study can afford to waste time, labor or money collecting unnecessary data or otherwise spinning wheels. Though mistakes are unavoidable, this step of the scoping process can help minimize, if not eliminate, mistakes related to "worrying about unimportant things". Significant issues should never be overlooked. However, it is not necessary to reanalyze issues that have been studied by others if the analysis meets the standards of the study.

The next task requires planners to identify all other planning activities that may have some bearing on the subject water resources study. Plans by all levels of government as well as the private sector should be considered. Knowledge of these plans may present opportunities for planners to share data bases, ensure a common set of working assumptions or adjust forecasts to account for foreseeable changed conditions.

Task five requires the Corps to be aware of any and all review and consultation requirements of any other government agencies. The intent is to assure that all necessary analyses are done in a timely and appropriate fashion and that coordination progresses smoothly.

Task six requires a preliminary schedule for the planning study and the decision process. Task seven suggests that scoping be part of all early planning activities. These steps are frequently addressed in an explicit fashion in a project study plan (PSP).

Scoping, when used effectively, can combine, eliminate and otherwise narrow the focus of the planning team to an appropriate subset of the theoretically boundless number of problems, opportunities, measures, plans, plan effects, uncertainty, etc. that arise throughout the planning process.

PLANNING IS AN ITERATIVE PROCESS

Planning is not a nice neat sequential process. It is more marble cake than layer cake. Understanding the iterative nature of the planning process is one of the more difficult things for new planners to grasp. You do a step and then you do it over and you keep on doing it until it is done. The steps will be finished in order when planning is done well. But, along the way, they may be started in any order and addressed a different number of times to varying extents before they are finished.

The discussion that follows begins with what we imagine might be some frequently asked questions about the iterative process. An iterative process is discussed in the section that follows.

*Planning is...more
marble cake than
layer cake.*

SOME FREQUENTLY ASKED QUESTIONS

What Is An Iterative Process?

Webster's *New Collegiate Dictionary* defines iterate as reiterate. Reiterate is defined as: to say or do over again or repeatedly sometimes with wearying effect. This latter part of the definition conveys a nuance many experienced planners can identify with easily. An iterative process, then, is one that is repeated, at times over and over.

What Is Iterated?

The six steps of the planning process are the things that are repeated. A planning iteration is essentially a pass through some or all of the six steps of the planning process.

Why Is The Planning Process Iterative?

It's impossible to anticipate, execute, and revise each of the six steps of the planning process in one run through the steps. *Typically, each iteration has a different emphasis.* In the early iterations, problem identification and resource inventories and forecasts receive more emphasis than in later iterations when the other steps are emphasized.

How Do Iterations Differ From One Another?

Iterations typically differ in the emphasis placed on the different planning steps. The six steps describe a logical and sequential thought process. The emphasis in the various iterations shifts at a varying rate from one step to the next in general accordance with the step sequence. That is, step one is generally emphasized before step two which is generally emphasized before step three, and so on.

Purists and Philistines Among Planners

Does each iteration start at step one? Does each iteration include all the steps? These are some of the questions planning purists and Philistines might debate in the locker room after a long day of planning. They differ little if at all over the reality of what planners do, it is more their philosophical views of what is done that digress.

The non-Federal partner walks in on day one of a study with a plan. Is the Corps' study team "starting" at step three? The Philistine says who cares. The purist says the author of the plan has already done steps one and two.

On the initial site visit the study team's senior member sizes up the situation and announces that dredge material from the channel can be used to create wetlands along the west bank of the river. There is already a front runner for the recommended plan. Has the planning process begun at step six? Again the Philistine says who cares. In the purist's view steps one through five have been done implicitly. They may have been private mental exercises, possibly done in the blink of an eye. Almost certainly there is no record of what the planner's assumptions were or why they were made.

There appear to be differing views on this aspect of the Corps' planning process. Some hold it is impossible to take the steps out of sequence. The preceding steps are always accomplished, albeit sometimes in implicit, undocumented, even snap judgments ways. Others believe the process is a bit more chaotic, can begin anywhere and proceeds at times in an almost random order.

Both would agree, however, the iterative planning process is ultimately rational and sequential. On this issue you are free to choose.

Iterations may also differ in their duration. It is quite possible the study team may make an entire iteration during their initial site visit. None of the steps will have been very detailed, but each step would have been preliminarily considered. As the sidebar on purists and Philistines indicates, some steps may be virtually instantaneously processed, while others can be long and laborious.

How Many Iterations Are Required?

If you're trying to count iterations you're missing the big picture here. There is no prize for either the most or the least iterations. You do as many iterations as it takes to arrive at the best plan. Iterations, like the six steps themselves, will rarely have a discrete beginning or ending other than the start and end of the study. The big picture view is that the steps are repeated. You do something then you do it again. The initial iteration of a step may be little more than an educated guess. Subsequent iterations may be because you have more definitive data or they may be simple fine tunings of an earlier result.

When Do You Stop the Iterations?

When all of the planning steps have been completed as fully and as well as they are going to be done in your study effort, the iterations can stop. The culmination of the iterative process is the identification of a recommended plan.

THE ITERATIVE PROCESS

What would the ideal iterative planning process look like? It's easier to describe what it is not, so let's begin there. Though the planning process is sequential it is not done by beginning only step one and completing it before moving to step two, then once that step is complete proceeding to step three, etc. That is a sequential step process devoid of iterations. Good planning cannot be done that way.

Iterations are necessary because the planning process is a fluid, dynamic, evolving process that relies on feedback loops of every stripe and variety. Information becomes available over time and our understanding is adjusted to reflect the increased understanding that comes from additional knowledge.

Levels of Iterations

Though there is no ideal or recommended number of iterations it is possible to identify different levels of iterations. Each level may require a variable number of iterations but generally the planning process can be recognized as passing through different levels. We've identified three.

The first level of iterations is devoted to identifying possibilities. The second level of iterations is the screening level. Possibilities are whittled down and evaluated. The third level of iterations is the optimization level. At this level plan dimensions are fine-tuned. This level culminates in the selection of a plan.

The basic theme running through these levels is an increasing sense of purpose and quality of information. Level 1 iterations can be likened to turning on a TV set. Level two is scanning the channels for possibilities. Level 3 is watching candidates for awhile and fine tuning the pictures and sound. When all levels are completed you select a show and watch. Or, you turn the TV off.

An ideal iterative process begins after an initial scoping process. The identification of problems and opportunities is the focus of the first iteration of the planning process. The study's early emphasis is on this first step. However, experienced personnel know that certain data are going to be needed. Mapping or hydraulics and hydrology, for example, will be required for many water resource studies regardless of the specific details of the problems. Efforts to obtain these data can begin simultaneously. This is important to the resource inventory and

description of baseline and without project conditions. Thus we have two steps beginning simultaneously, though the emphasis is on step one, problem identification.

In initial site visits, study team members will see situations that connect with some of their past experiences and begin to suggest measures that may work here or that won't work here. This kind of thought process is the embryo of plan formulation (step three). As soon as a team member begins to think about measures she applies some preliminary, often intuitive, evaluation, assessment, comparison and selection criteria. These are the first iterations of the later planning steps (four, five and six) and is a form of screening, discussed in more detail below.

As the problems and opportunities become well defined and give way to planning objectives (a process explained in the next chapter) the study team is better prepared to identify the data required to inventory relevant resources and complete the baseline and without project future condition scenarios. This represents a move away from the first step and an increasing focus on the second. What iteration are we in at this point? It doesn't matter. Problem identification may be completed in a single comprehensive iteration or it may be revisited dozens of times throughout the study. The number of iterations is not important, that the step is completed and done well is.

During this time people continue to make progress on tasks that contribute to the other steps. Team members begin to talk and compare notes and preliminary project sites may be identified along with the preliminary list of appropriate measures. When step one is essentially complete and planning objectives have been identified, people can begin to think about potential measures and their possible effects more explicitly. This can aid the evaluation, comparison and selection steps in this and subsequent iterations.

As the baseline conditions become defined and a forecast of the most likely future without a project comes into focus it is easier to begin to identify specific plans that can address the planning objectives and the creation of alternative futures. None of this precludes the fact that as the study progresses it may be necessary to go back and revise the problem definitions, the planning objectives, or any other supposedly completed step in the planning process.

In subsequent iterations, when specific plans are identified precise evaluations of the plans can be made. When the evaluations have progressed to a sufficient point, comparisons of the assessed effects of the plans will be made. All the while, revisions to previous steps may be on-going and subsequent steps will be anticipated.

Generally, the ideal iterative process is one in which the current step is being executed; previous steps are being revised and subsequent steps are being anticipated. Thus, each step passes through the stages of anticipation, execution, and revision. The number of iterations in each stage is purely arbitrary. Do as many iterations as it takes to do the job well.

It is fairly safe to say that the iterations end when the selection of a plan has been completed. At this point there is nothing more to do in the planning process. The Corps' planning process diverges from the generic model of Chapter Two because implementation of the plan is often considered an integral step in the generic planning process. Implementation is more appropriately considered part of project development, the larger process that encompasses the planning process. This distinction is more a matter of semantics than substance, however, because implementation is clearly the primary reason for planning for the Corps of Engineers.

SCREENING

Screening and scoping are frequently confused concepts, so let's begin there. *In scoping the different aspects of a study, the planner is making decisions about what is and is not important.* Scoping bounds the study effort. Screening, on the other hand, happens after scoping. We only screen from among important things, i.e., things that have survived the scoping process. *Screening is the process of determining what is important or interesting enough to consider further.* Scoping is deciding what is important or interesting enough to be considered at all and it is, like screening, an ongoing process. In this sense, then, scoping is the initial type of screening.

Use criteria and judgment to separate the good from the bad.

Think of the gold prospector panning for gold. He dips his pan into the stream and collects a variety of sediments in suspension in the water. As he shakes his pan back and forth, the worthless fines and sediments slip through the holes in the bottom of the pan; hopefully, leaving behind the gold the prospector seeks. The size and placement of the holes establish the criteria for what remains in the pan. There may even be more than a little bit of art to the process of winnowing out worthless sediments, perhaps the way sunlight reflects off the remaining sediments. Use criteria and judgment to separate the good from the bad: eliminating what is no longer of interest and extracting what is good and worth keeping from all that is available. This is the purpose of the screening process.

Any aspect of the study can be screened. Planners screen problems, objectives, data, forecasts, scenarios, measures, evaluations, assessments, alternatives, and so on. Screening is only applied to those things that have been considered to some extent. Screening is selecting the good parts of the work the planner has done, based on planning criteria, and considering them further.

Screening is necessary because as the study progresses the data, measures, alternatives, etc. can multiply. In order to maintain the problem solving, opportunity seizing focus of the study it is essential that the planner discern what

Criteria for Screening

cri•te•ri•on, *n.*: *pl. cri•te•ri•a*, a test, means of judging, a standard of judging; any established law, rule, principle or fact by which a correct judgment may be formed.

Screening is not an arbitrary process. Criteria are used to decide what data, measures, scenarios, plans, etc. pass through the screening process to the next iteration. Some of the criteria, such as the P&G criteria of completeness, effectiveness, efficiency, and acceptability (discussed in Chapter Seven), are given for all planning studies. Other criteria are derived from the specific planning study, based on the planning objectives and the opportunities and problems of the affected communities.

is worth considering further and what is worth eliminating. It's the only way to go from the many to the few to the one.

Screening is more than the application of steps four (evaluation), five (comparison), and six (selection). These are the specific steps used to select good plans from all possible plans, better plans from good plans, and the best plan from among the better plans. Indeed, these steps comprise part of the screening process. Evaluating, comparing and selecting plans is the formal part of the screening process. However, screening is not limited to the screening of alternatives.

Data are screened. Measures are screened. You name it and there's a good chance you can screen it. *The evaluation and assessment of data and measures, however, are not to be confused with the evaluation, comparison and selection of alternative plans.* They are two different applications of the screening process.

The process by which an analyst decides which population forecasts are best may be more or less formal. It may be as simple as considering the credibility of the organization that prepared the forecast or it may involve a more detailed examination of how well the forecasts have predicted actual populations. The screening process is a flexible one that is not well-defined in order to provide the planner with the flexibility she needs to get the job done well.

The exception to this flexibility is encountered in the screening of alternative plans. Here the process is prescribed by the planning process; you apply steps four, five and six. The alternatives are evaluated, compared and the good ones are selected in the early iterations. In later iterations the better ones are kept. In the final iteration the best plan is selected. *Screening is an essential part of each iteration of the planning steps.* If the iterations are devoid of screening we run the risk of entering an endless loop in which the same alternatives are considered over and over with no progress toward identification of a recommended plan. Screening ideas and plans over a number of iterations is the essence of how a best plan emerges from a sea of potential plans.

SUMMARY AND LOOK FORWARD

Scoping is the initial and ongoing step planners take to focus the various study activities on what is important and doable. Screening is the ongoing process of eliminating, based on planning criteria, what is no longer important or

interesting from further consideration. Alternatively, screening is the process of preserving what is important. Scoping and screening are ongoing processes throughout the iterative planning process. The iterative nature of the Corps' planning process is one of its most distinguishing features. It is through the process of repeating the planning steps and screening elements of the planning study that the recommended plan eventually emerges.

Absent from our conversation to this point are the details of what the planning steps are. That description begins with step one in the next chapter.

CHAPTER SIX: STEP ONE - PROBLEMS AND OPPORTUNITIES

"Would you tell me, please, which way I ought to walk from here?" "That depends a good deal on where you want to get to," said the Cat. "I don't much care where---" said Alice. "Then it doesn't matter which way you walk," said the Cat. FROM LEWIS CARROLL'S *ALICE'S ADVENTURES IN WONDERLAND*.

STEP ONE: "Specification of the water and related land resources problems and opportunities (relevant to the planning setting) associated with the Federal objective and State and local concerns." (P&G STANDARDS, SECTION III PARAGRAPH 1.3.2 (A)(1))

INTRODUCTION

As the conversation between Alice and the Cat points out, if you don't know where you're going it doesn't matter which way you go. *In water resources planning it is essential that planners have a sense of the direction in which they want to head.* That sense of direction is obtained in the first step of the planning process.

Historically the nation's goals and objectives in water resources planning and development have reflected national values. These national values have evolved and changed over our two centuries as a nation as new problems, challenges and opportunities have emerged. Water resources projects have been planned and implemented to solve those problems, meet those challenges and seize those opportunities. If they did not, they would serve no purpose.

Without a clear statement of the problems to be solved or the opportunities to be seized, there is no rationale, no reason for planning. As the first step, identification and specification of the problems and opportunities to be addressed is the most important step in the planning process that follows. This first step is essentially the mission statement of the Federal/non-Federal partnership. It is an enduring statement of purpose that distinguishes this partnership from all others.

...identification of problems and opportunities ensures unanimity of purpose within the partnership.

The identification of problems and opportunities ensures unanimity of purpose within the partnership. Solving these problems and taking advantage of these opportunities provides a basis for motivating and allocating their pooled resources. This step provides a focal point for all stakeholders in the planning process. It says, "This is why we are undertaking this study." Identification of problems and opportunities facilitates translation of the partnership's purposes into appropriate planning objectives. The concerns of both the Federal and non-Federal partners are

identified in this step. Ultimately, strategies or plans to meet these objectives will be produced. The culmination of the planning process depends critically on the success of this first step.

There are five critical concepts in this chapter, grouped in three topical headings. They are: problems and opportunities, constraints, and goals and objectives. Understanding these concepts is critical to the success of the planning process. Before these concepts are introduced, however, some elements of the planning setting, mentioned in the P&G definition of this first step, are described.

PLANNING SETTING

Water resources planning takes place in a context or setting that planners need to understand. This setting is determined by national values, goals, objectives, policies, programs and constraints. It exists in a political, economic and social context that is unique to the age in which the planning is undertaken. Inasmuch as this context has changed and evolved over two centuries it preexists the first step of the planning process and must be understood before one begins to plan. No activity exists without context and so this chapter begins with an overview of the context Corps planners find themselves in at this point in time. That context is described in part by the P&G and it is further developed by the Corps and the conventions of the planning community. We call that context the **planning setting** and some of its elements are described below. Three of its major elements were the subject of the preceding chapter.

PARTNERSHIP

The P&G (p. 3) mandate that the planning process be a "coordinated planning effort". The Corps of Engineers has gone substantially beyond this mandate to create a **Federal/non-Federal partnership** in water resources planning. The planning jurisdiction for the nation's water resources is clearly Federalist in structure with both the Federal and state/local levels of government involved.

Borrowing from the language of the private sector, a partnership can be defined as a business co-owned by two or more partners. They share in the profits and the debts of their enterprises. The sharing of profits and debts need

The partnership exists...to serve the interest of the partners by meeting the needs of their customers.

not be equal, the terms of the partnership may vary from case-to-case. The partnership exists, however, for one primary purpose: to serve the interests of the partners by meeting the needs of their customers.

Planning Area Examples

A beach erosion project may require upland borrow sites several counties removed from the eroding beach. The planning area should include the area that includes the beach and the borrow sites. If the beach is a significant recreation resource, the planning area should include the region from which significant numbers of tourists come.

A deep water port improvement study need not include the entire United States and all the foreign countries from/to which commodities move. It would be sufficient to define the planning area as the hinterland of the port. That is, the area from which most exports arise and the area to which most imports are destined. This is the area that encompasses the bulk of the economic, social, and political impacts of the port and port-related activities. It is not uncommon for such areas to encompass numerous counties and several states.

A local flood control project may be confined to a single community, e.g., in the case of a Section 205 study. It is common practice to use the political jurisdiction(s) or economic area encompassing the flood plain as the planning area. In instances where goods and services produced in the flood plain have a significant impact on other areas they should also be included.

Few studies explicitly consider the source of construction materials when defining planning areas. When unique resources are required for implementation, like beach borrow, large rocks for jetties, etc., the impact of the project on the source areas should be considered when defining the planning area.

In the past, Corps planners have often seen the "local sponsor" as their customer, the entity whose needs are to be met. In a partnership, one's partner is not the customer. One's partner is the party relied on to help meet the needs of the customer.

It is easy for some planners to think their job is to complete planning studies. In this mode of thinking the customer would appear to be the one who makes the plan possible. That would be the non-Federal partner who signs a **Feasibility Cost-Sharing Agreement (FCSA)** or **Project Cooperation Agreement (PCA)**. Without them there is no one to share study costs or to provide evidence of a significant need for the study.

This is not the proper view of a planner's job. Meeting human wants and needs is perhaps the simplest statement of a planner's job. Solving problems and taking advantage of opportunities to improve the quality of life for present and future generations is another way to describe it. The customer is the community. The people of the study area specifically and the people of the United States more generally are the partnership's customers.

Thus, the planner participating in the new partnership must keep a clear focus on who the customer is. Obviously, all partners have to be satisfied in order for a partnership to work. However, the customers' needs must come first or there is no reason for a partnership to even exist. Once the basis for the partnership is understood the needs of the customers must come before the agendas of the individual partners.

PLANNING AREA

What geographic area should we take into consideration when formulating plans? The area we end up considering is called the **planning area**. Related concepts include the **study area**, **project area**, and **affected area**. Though related in meaning, each has its different nuances. When planning, the planning area is of particular interest.

Planning areas may encompass administrative regions, political jurisdictions, states, and watersheds. River basin planning has long been recognized as the most logical basis for planning the development and preservation of water resources. Though basin level planning is beginning to enjoy a resurgence, many Corps planning studies are still implementation studies that affect an area that does not encompass an entire river basin.

The P&G (1.4.7) define the planning area as a geographic space that includes the following:

“(a) The area defined in the study’s authorizing document; (b) The locations of alternative plans, often called “**project areas**”; and (c) The locations of resources that would be directly, indirectly, or cumulatively affected by alternative plans, often called the “**affected area**.”

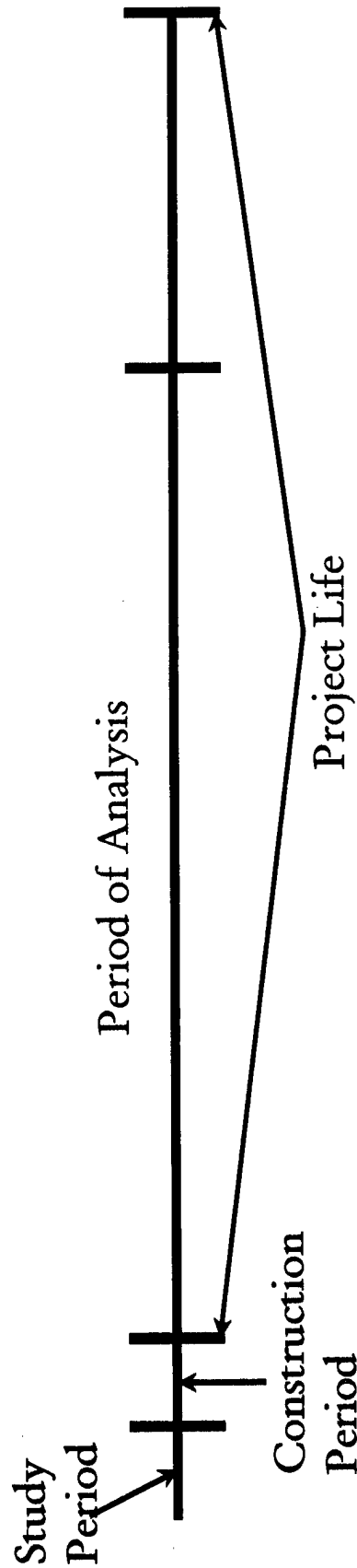
It may be helpful to add that the planning area would be the larger and more inclusive of these three areas.

The affected area definition may be the most practical and useful definition of the planning area. The spatial extent of problems and opportunities identified must be traced out to their ultimate physical locations so the planning area can be established. For example, if resource management within the recommended project area has significant impacts on activities outside this area, the planning area must be modified to include them.

PERIOD OF ANALYSIS

How long a time period should we use when considering the impacts of plans? We should consider only the time it makes sense for us to consider. This time frame is called the **period of analysis**. It’s the period of time over which we think it is important to extend our analysis of plan impacts. This time period is frequently confused with the **planning horizon** which is a longer and more encompassing concept. Figure 4 shows the period of analysis is part of the planning horizon.

Figure 4: Planning Horizon



The time it takes to conduct the study and implement/construct the plan are not part of the period of analysis even though they are part of the planning horizon. The project may last longer than the period of analysis. The period of analysis is the subset of the planning horizon over which we consider plan effects.

The first rule for choosing a period of analysis is you must use the same period of analysis for each plan considered in a study. To do otherwise would mean that we are considering different time streams of plan impacts and that would render any comparisons of plans invalid. The period of analysis is never over 100 years. Forecasting conditions and impacts beyond 100 years is pure guessing even if some structural projects may last more than 100 years.

If significant impacts do not last 100 years, the period of analysis should be restricted to the duration of the significant impacts. Significance can be measured in many ways. One of the most common measures has to do with the time value of money. Future dollar values, whether benefits or costs, are worth less than current dollar values. Discounting is the process used to place dollar values incurred at different times on an equivalent time basis. After 50 years the discount factor alone reduces monetary values to a mere fraction of their former value¹¹. Unless the future dollar values being discounted are large there is no apparent point to continue to include these values among project impacts.

INTERDISCIPLINARY TEAM

Once, virtually all water resources planners were civil engineers. They were trained to meet needs by building a structure of some kind. Technical solutions were emphasized over social goals in the planning process. The

Period of Analysis

ER 1105-2-100 on page 5-9 defines the period of analysis as follows:

- (1) The period of analysis is to be the same for each alternative plan. The period of analysis is to be the time required for implementation plus the lesser of:
 - (a) The period of time over which any alternative plan would have significant beneficial or adverse effects; or
 - (b) A period not to exceed 100 years.
- (2) Appropriate consideration should be given to environmental factors that may extend beyond the period of analysis.

¹¹ For example, if the discount rate is 10%, one dollar 50 years from now is worth only \$0.0085. At 7% the same dollar is worth \$0.0339.

conservative perspective of engineers often encouraged them to over design structures for the extreme conditions that might cause them to fail.

...the team should be interdisciplinary not merely multi-disciplinary.

Planning is no longer done this way. Over time, national values and goals changed. Economic, social, and environmental concerns are now as or more important than engineering concerns. The new partnership has encouraged an informed willingness to trade implementation costs off against the possibility of project failure. As a result of the proliferation of goals and objectives that must be addressed by water resources planning studies it is impossible for any single discipline to adequately address the more complex issues that arise in a world that is multi-objective in its outlook. *Many disciplines are needed for planning.* Table 15 lists some of the disciplinary expertise that might be required for a typical planning study.

Table 15: Selected Study Team Disciplines

- Aquatic and terrestrial vegetation
- Game and nongame wildlife
- Fisheries
- Terrain, soils, minerals
- Climate
- Archaeological, historical & cultural resources
- Recreation
- Demographics
- Education
- Public health
- Agriculture and industry
- Transportation
- Civil engineering
- Hydrology & hydraulics
- Water and air quality
- Water supply and waste disposal
- Geologic, structural, mechanical & electrical engineers
- Economics
- Urban planning
- Computer scientists
- Operations research
- Decision sciences

In addition to a diversity of disciplines the planning team should include a diversity of interests including other government agencies. Some districts feel it is their job to do all of the planning. That is what the non-Federal partner is paying for, they contend. Other districts insist that the non-Federal partner actively participate in the planning process. Clearly, there can be no best balance of partner roles that works for all studies in all districts. However, it is essential that the non-Federal partner be afforded as much a role on the planning team as it is willing to assume.

An often overlooked point is that the team should be interdisciplinary not merely multi-disciplinary. The disciplines are to be integrated. It is not sufficient to assemble a group of diverse experts. They must communicate their various viewpoints and work together to fashion plans that truly reflect a diversity of viewpoints on the problems and opportunities that confront the planning area.

We are all trained in our specific disciplines. These disciplines have, over time, developed their own specific and occasionally peculiar way of looking at the world. At times we have been trained to screen out those aspects of the world that conflict with our disciplines way of looking at things. If we are to have an effective planning process we must have an interdisciplinary team from the very beginning.

Some major characteristics of interdisciplinary planning include:

How to Integrate an Inter-Disciplinary Team

When you assemble a study team with many different disciplines represented you have an multi-disciplinary team. When those team members begin to listen to the viewpoints of others; when they see the importance and relevance of the views of others; and, when they respect and consider the views of others, the team has become interdisciplinary. For this to happen, the study manager has to be a facilitator not an "answer man". She has to create an environment in which each discipline has a role that includes an opportunity and a responsibility to contribute to the planning process.

- 1) Group meetings with all disciplines and interests represented.
- 2) Participation by all disciplines in the development of alternatives.
- 3) High degree of communication and informal coordination among all team members especially engineers, economists and environmental specialists.

This discussion of interdisciplinary planning ends with a caveat. There is, in some quarters, a tendency to turn environmental planning over to the environmentalists. This is a crucial mistake every bit as misguided as the past practice of letting engineers do the planning. The environmental scientists' and environmentalists' roles in environmental planning are crucial but

they represent only one of many legitimate viewpoints.

STAKEHOLDERS

Stakeholder is a word used in water resources planning that has come to mean a person or group of persons who can stop you or whose support is necessary for success. A stakeholder is someone with something to lose or gain from a recommended course of action. The stakeholders are crucial to the specification of problems and opportunities. Identifying the stakeholders is the first important step in involving them in this process. Table 16 presents some additional roles for stakeholders.

The Federal and non-Federal partners are two obvious stakeholders in a study. Government agencies at all levels of government are frequent stakeholders. Organizations and individuals that have an interest in the project should be included as should public interest groups with a particular point of view that bears on the project. These groups might include civic, social, environmental, economic, recreational, public health, political, educational and other interests. All other individuals and organizations who have an apparent interest in the project should also be invited to participate.

Table 16: Roles for Stakeholders

- Identify problems and opportunities related to planning area water resources
- Identify legal requirements, funding limitations, or other constraints and ensure the plan is compatible with them.
- Take advantage of technical expertise that may be available in the various publics involved.
- Identify and clarify positions of different groups and individuals affected by the plan.
- Identify sensitive issues and ways of preventing or reducing adverse impacts.
- Overcome conflicts and reach a consensus when there are different points of view with respect to plan components, particularly when multiple objectives are involved.
- Gain support for the project or project implementation.

Stakeholders are identified in a number of ways. They may identify themselves by coming forward to express their interest or concerns. Third-parties can identify groups or individuals who may be stakeholders. A review of District mailing lists, associations in the area, user groups, newspaper articles, etc. may suggest individuals or groups the planning team should consult with in step one and throughout the planning process.

SPECIFICATION OF PROBLEMS

WHAT IS A PROBLEM?

A problem is a question, matter, situation or person that is perplexing or difficult, says *Webster*. We can think of it as an undesirable condition. For planning, however, we'll use a more specific definition of a problem. *If we define a problem as an impediment to achieving an objective, then planning is both objective seeking and problem solving.* With this definition we establish the crucial link between problem identification and planning objectives, perhaps the central point in this chapter. *Objectives describe possible worlds. Problems stand in the way of realizing those worlds.* Problem identification focuses on identifying the impediments to "better worlds".

Problem definition is the detailed description of a problem. The problem definition includes the nature, cause, location, dimensions, origin, time frame, and importance of this problem, as well as an indication of who considers this a problem. *A problem statement is a simple, usually one sentence assertion of what the basic problem is.*

HOW DO PROBLEMS GET IDENTIFIED?

Plans are formulated to achieve planning objectives. Planning objectives are inexorably linked to problems. Thus, clearly articulated problem statements are essential to the success of any planning process.

Problems are identified in three primary ways. *First, the study authority describes the problem in general terms.* For authorized studies this usually includes a location and an identification of the basic problems to be investigated. *Second, public concerns identify problems.* *Third, technical analyses of study area conditions identify and verify the dimensions of problems identified by study authorizations and the public.*

WHAT DOES A PROBLEM STATEMENT LOOK LIKE?

Pick up any Corps planning study and you'll find a section entitled "Problems and Opportunities." Read it and you'll usually have a good idea what problems the study is going to address. It is rare, however, to find a clear and concise statement of what the problems in the study are. It is far more common to find a problem described and defined in a piecemeal fashion over several paragraphs of text than it is to find a direct statement of a problem like, "The problem is loss of coastal wetlands along Utopian Point." It may require many paragraphs to properly characterize the nature, cause, location, dimensions, origin, and importance of this problem but it is important to be able to clearly state it. *If a planner can't finish the sentence, "The problem is . . ." clearly and concisely then nothing else that follows in the study is likely to be very clear either.* Every study should include a problem statement.

Good problem statements never include solutions or the suggestion of a specific solution.

Study Authorizations

When it comes to problem identification, study authorizations merely point planners in the right direction. They are usually too general to be specifically useful in identifying problems. Following are excerpts from a typical authorization.

"Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on the Anacostia River and Tributaries . . . with a view to determining the if further improvements for flood control, navigation, erosion, sedimentation, water quality and other related water resources needs are advisable at this time."

A Simple Problem Statement

A problem statement need not be elaborate. It can be as simple as the following example.

Franklin Creek Basin Problem Statement

The problems in the Franklin Creek Basin are:

- 1) Loss of fish habitat in Franklin Creek due to urbanization;
- 2) Flood damages in the industrial section of Central City;
- 3) Streambank erosion along Campus Park;
- 4) Saltwater intrusion in the Franklin Bay estuary;
- 5) Loss of coastal wetlands along the South Ditch section of Franklin Bay.

The definition of these problems will take considerably more explanation. Each problem should be thoroughly developed in the report text. It is important, however, that planners understand exactly what problems they are addressing and that interested parties can see a clear statement of the problems under consideration.

WHAT A PROBLEM IS NOT

Good problem statements never include solutions or the suggestion of a specific solution. "The problem is we don't have a floodwall," is not a problem statement. As a matter of fact it skips the entire planning process and jumps to the selected plan. All the planner has to do is figure out the details; where the wall should go, how high should it be, etc.

The problem is not that someone does not have a floodwall. The problem may be that the watershed is developing without thought being given to the effects on runoff and streamflow, thus expanding the floodplain and exacerbating floods. The problem may be unrestrained development of the floodplain itself. It may be lack of advanced warning of impending floods. The problem may be the catastrophic damages that occur with infrequent flooding. Or, it could be the minor nuisance associated with frequent floods. The problem is not what the customer wants but doesn't have. The problem is usually far more complex than that.

IDENTIFYING PROBLEM CAUSES

The problem definition should include a discussion of its cause. If the underlying causes of a problem are not identified the solutions can end

up being superficial and unsuccessful. Unfortunately, people often begin to complain about problems long before the underlying causes are known. People know the fish are disappearing from a creek long before they know why. The solutions to the problem can vary considerably depending on whether the cause is overfishing, loss of habitat, disease, or declining water quality due to increasing urbanization.

PROBLEM IDENTIFICATION IS AN ITERATIVE PROCESS

It is to be expected that problems may be incompletely identified early in the planning process. *Problem identification is an iterative process.* As objectives and our understanding of the impediments to our objectives become clearer, the

problem identification becomes clearer. Problem definitions become more clear as data become available and technical analyses are completed.

Problems should be scoped early and often in the study process. Problems should be identified by everybody involved in the planning process. There is no better way to avoid a credibility problem than by paying attention to a person's issue (no matter how tangential it may seem). To assure a full and proper identification of problems, the public should be involved from the very start of the study. It is one of the best ways to avoid surprises later in the study.

SETTING PROBLEM PRIORITIES

The planning team must decide which problems to address. Due to limited resources the partners will be unable to address all of the problems that may arise in the planning process. Thus, a technique is needed to prioritize problems. The strategic planning literature offers a number of prioritizing models. One relatively straightforward model is the problem matrix shown in Figure 5.

The number of rows and columns is arbitrary, as are their headings. The matrix is a systematic approach to categorizing potential problems by their impact and the likelihood of their occurring. In the example, the most extreme impacts are considered emergency priority problems when they have a high or moderate chance of occurring. The least troublesome problems, the scratchers, are at worst only moderate priorities. The exact structure of the matrix is arbitrary. Once a serviceable matrix is designed the planners must place the problems they are considering in the appropriate cell. Then, based on their resources and resource constraints they can decide which priority problems will be addressed.

*...define an opportunity
as a chance of achieving
an objective.*

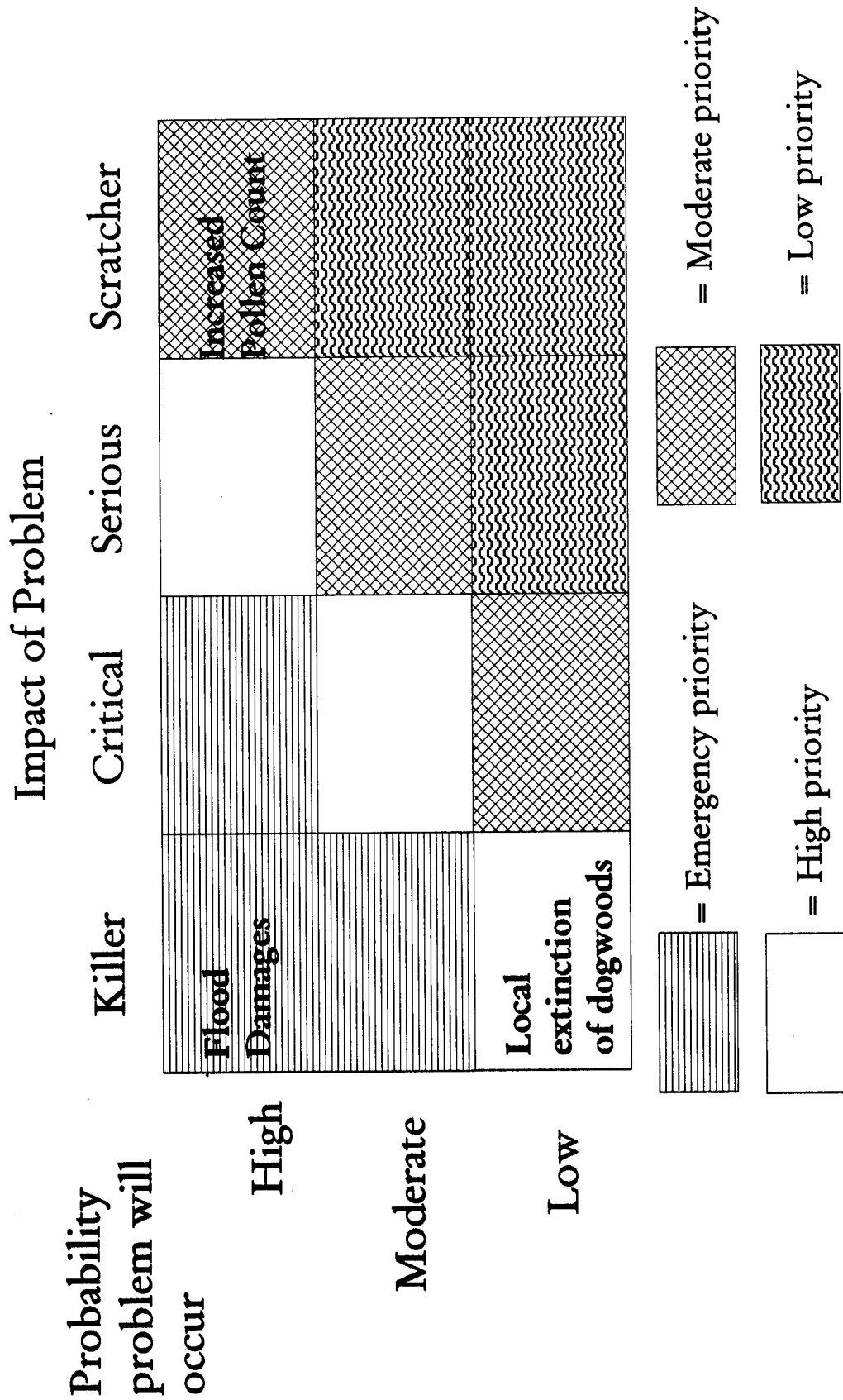
SPECIFICATION OF OPPORTUNITIES

WHAT IS AN OPPORTUNITY?

Not everything is a problem and problem solving is only part of the water resources development story. Paralleling our problem definition we might define an opportunity as a chance of achieving an objective. If objectives describe possible worlds, and not just fantasies, then opportunities are simply favorable chances to achieve one of those worlds. Water resource projects may provide those chances.

There may be many opportunities to realize an improved situation. The opportunity identification process needs to focus only on the best opportunities. In practice, there may be a tendency to treat capitalizing on opportunities as less important than solving problems in the planning process. This stems from an outdated philosophy of planning as problem solving rather than

Figure 5: Problem Matrix



objective seeking. Capitalizing on opportunities is every bit as important as solving problems.

A Simple Opportunity Statement

An objective problem statement need not be elaborate. It can be as simple as the following example.

Franklin Creek Basin Opportunity Statement

There are opportunities in the Franklin Creek Basin to:

- 1) Increase wildlife habitat along Campus Park.
- 2) Restore indigenous fish species in the upper basin.
- 3) Provide increased recreational opportunities along the waterfront.

Paralleling the discussion of problems above, a study should include a statement of opportunities and accompanying definition of the opportunities. Opportunity statements never include solutions and their development is an iterative process.

OPPORTUNITY MATRIX

An opportunity matrix can be a valuable tool in prioritizing opportunities. Like the problem matrix above, it is somewhat arbitrary in size. The example in Figure 6 shows three impact categories and three probability of success categories. Once the potential project opportunities are placed in the proper cell, the planning team can determine which opportunities look best for the planning study, based on study resources and constraints.

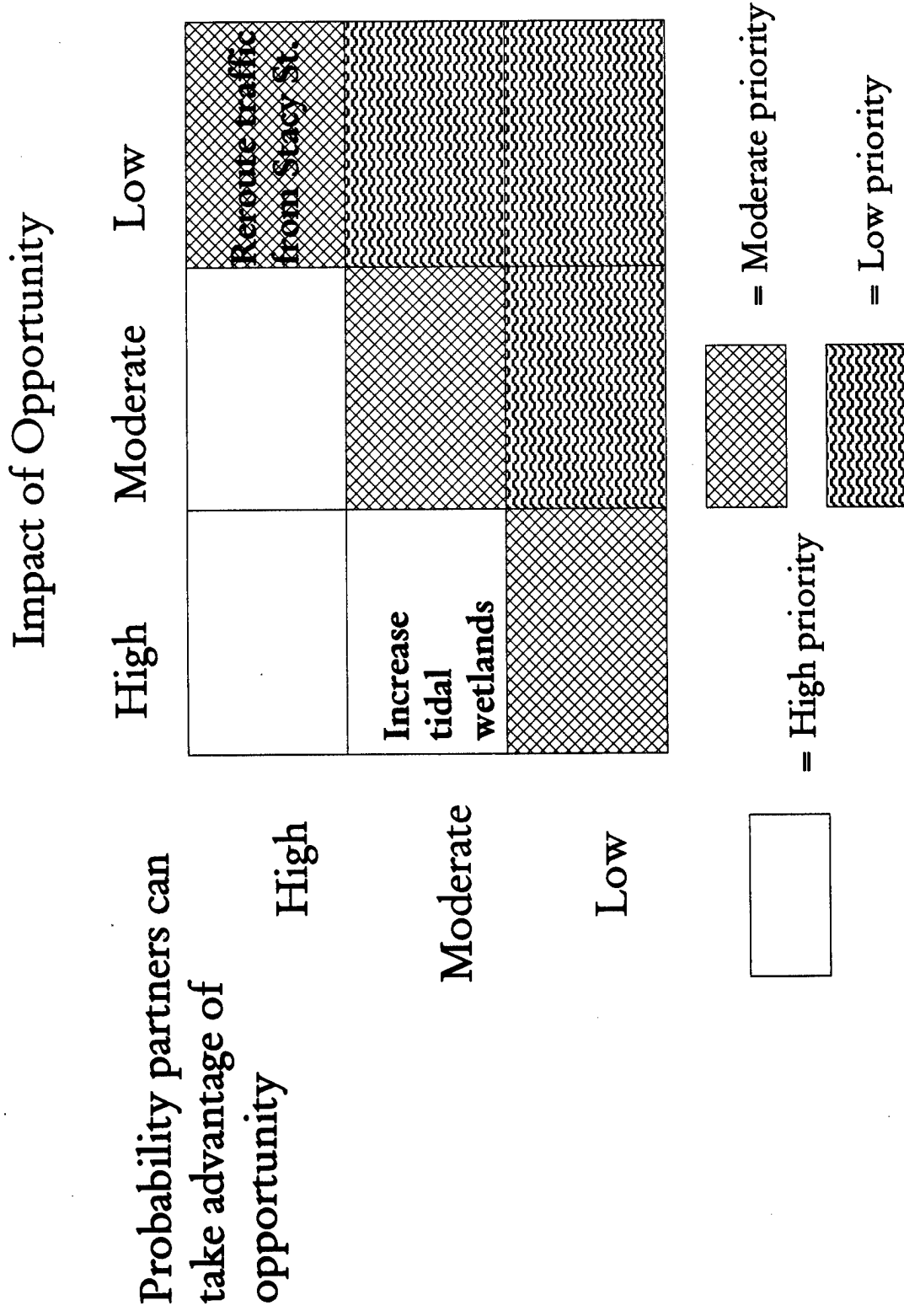
SPECIFICATION OF PLANNING GOALS, OBJECTIVES AND CONSTRAINTS

Once problems and opportunities have been identified it is time to decide what will be done about them. This is done through the specification of planning goals, objectives and constraints. In the first couple of sections that follow, goals and objectives, then constraints are defined. Following that, the specification of planning objectives and constraints is discussed.

GOALS AND OBJECTIVES

Webster's New Universal Unabridged Dictionary defines a goal as the end or final purpose. An objective is defined as something aimed at or striven for. These definitions establish a hierarchical structure that suggests we set goals first, then establish objectives that will help us attain our goals. With this simple order in mind we can begin to understand the complex world of Federal objectives and planning objectives.

Figure 6: Opportunity Matrix



Every organization has its goals and objectives. In water resources planning the objectives of the Federal government become the goals for the planning partnership. The study team then develops objectives to help reach that goal as well as any other goals they seek in their planning effort.

In water resources planning, the objectives of the Federal government become the goals for the planning partnership.

FEDERAL GOALS AND OBJECTIVES

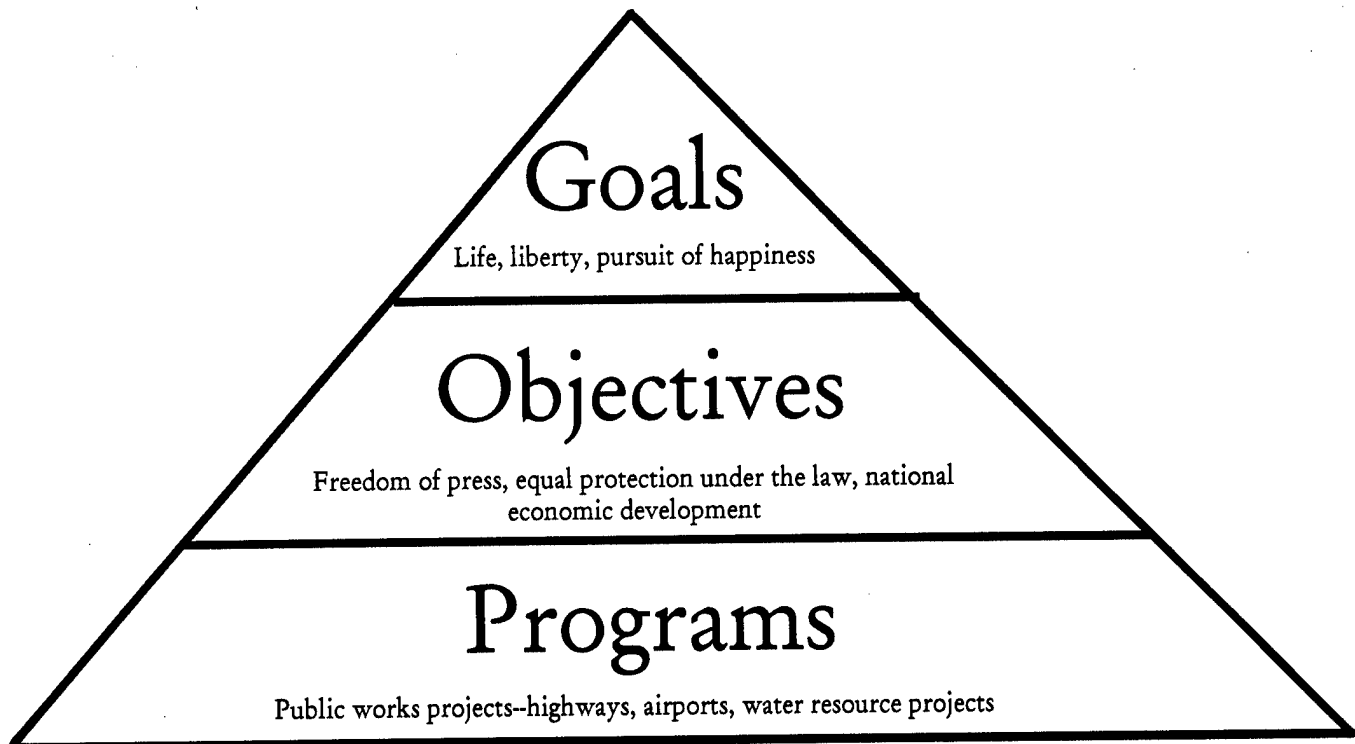
Suppose for the sake of simplicity that we take life, liberty and the pursuit of happiness as some of the goals of the Federal government. These are ultimate destinations for the citizens of this country. The goal statements do not suggest a way to achieve these goals, however. Suppose, then, the Federal government sets freedom of the press, equal protection under the law, and national economic development as examples of objectives that could help us attain our national goals. Let's further suppose national economic development can be achieved through a variety of programs like monetary policy, job training, education, and public works projects. In turn, public works projects could consist of highways, airports, and water resources projects. At the national level we have described the hierarchy shown in Figure 7. Thus, we have national economic development as a Federal objective. That Federal objective becomes a goal for the Corps' planners in each of their planning studies.

PLANNING GOALS AND OBJECTIVES

Because this is a planning manual let's not worry about the goals and objectives of the Corps or their planning partners for now. Instead let's think about a specific planning partnership. Where do the planning goals come from? Generally, the planning goals are the objectives of some organization higher up in the hierarchy. For example, the P&G make it clear that national economic development is the Federal objective. National economic development, from the Federal government's perspective, is the final purpose of a water resource project. It is not something that water resources projects are aimed at, it is the entire reason the Federal government is involved in water resource development. *Plans are not formulated specifically for national economic development, that is understood as the reason for the program's existence.*

What is the NED objective to the planning partnership? It is a planning goal. *The Federal objective becomes a planning goal.* The planning team must develop planning objectives that will help the partnership contribute to that goal. There can be other goals as well. They may be defined by the non-Federal partner or any of the stakeholders. The goals will be unique to each study but in a generic sense we can say that solving problems and seizing opportunities are always among the planning goals. The specific problems and opportunities will, of course, vary from study-to-study. As a general rule planning studies do not discuss planning

Figure 7: National Goals and Objectives



goals. *NED, problem solving and opportunity seizing are essentially givens for any study.*

Thus, for a planning partnership Federal (and non-Federal) objectives become planning goals. The objectives of the organizations higher in the hierarchy become the goals of the planning partnership. Planning objectives must then be developed to help attain these goals. Planning objectives are defined as the statement of the intended purposes of the planning process. A planning objective is a statement of what an alternative plan should try to achieve. More specific than goals, they effectively constitute the mission statement of the Federal/non-Federal planning partnership. Planning objectives are discussed at greater length in the sections that follow.

CONSTRAINTS

A constraint is basically a restriction that limits the extent of the planning process.

We live in a world of scarcity where it is not possible to do everything. Our choices are constrained by a number of factors. Planning is no exception. An essential element of any planning study is the set of **constraints** confronting the planners. A constraint is basically a restriction that limits the extent of the planning process. Constraints, like problems and opportunities, are unique to each planning study. *Two distinctly different categories of constraints can be identified. First, there are resource constraints on the planning process.* These include limits to our knowledge/expertise, experience, ability, data, information, money, and time. These constraints limit the scope of a study in significant ways. *Second, there are planning constraints.* These are the constraints that restrict plan formulation. These can be divided into two subcategories. First, are the **universal constraints** that apply to all studies of a given type. These constraints include legal and policy constraints. Second, are the **study-specific constraints** that vary from study-to-study.

The significance of constraints is that they can limit choice. If we take the simple view that more choice, i.e., more options for accomplishing a task, is generally preferred to less choice, i.e., fewer options, then constraints are a negative influence on the planning process. Easing or removing constraints should be done whenever possible. Each type of constraint is discussed further below.

Resource Constraints

Limited knowledge and expertise often constrain the planning process. The personnel involved in the study may simply lack the knowledge and skills required to address certain complex problems. Other times, the state-of-the art is limited. The theory may be new and underdeveloped. For example, there are serious

restrictions imposed on our ability to develop ecosystem restoration plans because our understanding of ecosystem function is so limited.

Experience constraints are somewhat different. Though an individual may be well trained and possess considerable expertise, until they gain experience with the planning process, they will not be as capable and productive as those with experience.

Money is a universal constraint.

Closely related to these two types of constraints is the ability of the planning personnel. Some personnel are simply not as well motivated, suited or talented as others. When a planning team's abilities are limited the planning process will generally be constrained to something less than it would be with better motivated, better suited and more talented employees.

Data are important to any planning effort. If planners lack adequate data about stream flows, environmental resources, the physical setting, property at risk, volumes of traffic, or other important aspects of the study, the study will be severely constrained.

Money is a universal constraint. Most of the constraints discussed to this point can be eased, if not removed, by the expenditure of additional funds on the acquisition of more and better resources, be they personnel or data. Study budgets are the primary sources of planning funds and study budgets are becoming increasingly lean in the current fiscal environment at all levels of government.

Time is the second universal constraint on planning activity. There may not be time to do all that is desired to complete a study or a component of a study. The typical reconnaissance study, for example, must be completed in 12 months leaving far less time to complete the desired analyses. It may be desirable to have a few years of tidal data to try to establish tidal wetlands, but there may be no time to collect it.

It is difficult if not impossible, at times, to untangle the web of constraints that are associated with a planning activity. We may not have sufficient data because it doesn't exist (data constraint); we may not have time to gather it (time constraint); there was not enough money to collect it (money constraint); or, our personnel may not be experienced/knowledgeable/able enough to know it was needed or how to go about getting it. Sometimes constraints overlap and interact in ways that make it virtually impossible to understand exactly what is restricting the planning activity.

Planning Constraints

Some constraints result from our lack of specific resources. These are the real world constraints that restrict all activities. In the face of these constraints you do the best you can. But, there is an entirely different class of constraints that

affect planning studies in a very different way. They are akin to planning objectives, we call them planning constraints.

Planning objectives are the things we want to accomplish with a plan, i.e. they are the desired changes between the without and with project conditions. In contrast, planning constraints are things we want to avoid doing. Planning constraints have been called negative planning objectives. That would make them undesirable changes between without and with plan conditions. They are things we don't want to "mess up" with our plans. While plans are formulated to achieve planning objectives, they are never formulated to achieve planning constraints. In fact, they should be formulated to avoid violating the constraints.

Is it an Objective or a Constraint?

Some things are clearly objectives. Others are clearly constraints. Some seem to lie in a nether world between the two. The general rule of thumb is if the no action plan satisfies the statement in doubt it's probably a constraint. Conversely, if you can formulate a plan that beneficially contributes to the statement in doubt it's an objective.

Take the simple statement, "Protect threatened and endangered species." If the number of organisms is declining over time under the without project condition and you can formulate a plan that slows or reverses this trend, it is an objective. On the other hand, if the number of organisms is at an acceptable level now and throughout the without project condition future scenario then it is a constraint.

Confusing? If so, don't get hung up by esoteric concerns. Remember it's far more important to protect the species than to worry about calling an objective a constraint.

Universal Planning Constraints

There are a number of legal and policy constraints that need to be included in every planning study. They may vary from study type to study type, but for a given type of study there are some predictable constraints. For example, you don't formulate plans that intentionally adversely affect threatened or endangered species. The Corps of Engineers will not formulate flood damage reduction plans for streams where the 10% discharge is less than 800 cubic feet per second. The Corps' guidance, regulations, policies and authorities define some of these constraints. Others are defined by the laws and regulations of the Federal government and the applicable laws and regulations of the State and local governments.

Study-Specific Constraints

A study-specific planning constraint is a statement of things unique to a specific planning study that alternative plans should avoid. While universal planning constraints are applicable from one study to another, study-specific planning constraints are not. Examples of study-specific constraints include the following:

- 1) Minimize salinity intrusion into freshwater aquifers.
- 2) Minimize loss of flood protection from existing levee.
- 3) Minimize shoreline erosion related to navigation.

SPECIFICATION OF PLANNING OBJECTIVES AND CONSTRAINTS

Planning objectives and constraints are indications of what is important to people. Planning by objectives, i.e., formulating plans to meet valid social, environmental, economic, and engineering objectives and to avoid undesirable consequences, is what the planning team is supposed to do. This is very different from planning to maximize NED benefits. The difference in the two philosophies stems from the manner in which project specific planning objectives are approached.

Planning objectives and constraints are indications of what is important to people.

When specifying planning objectives and constraints is an exercise to be checked off of a planning team's "to do" list we see the latter form of planning. *The planning objectives and constraints are in reality a statement of the reasons for the planning effort.* The objectives and constraints should reflect the views of the public regarding the problems and opportunities of the planning area. They are the list of outputs that are desired from a project. The planning objectives and constraints are the reason for the Federal/non-Federal partnership. They are, in a sense, the partners' mission statement - that enduring statement of purpose that distinguishes this partnership from all others. Plans are formulated to meet the planning objectives and to avoid the constraints, there can be no other reason for a plan.

CRITERIA FOR GOOD OBJECTIVES

Table 17 summarizes some criteria for good planning objectives. They are discussed in turn below.

Table 17: Criteria for Good Objectives

- Specificity
- Flexibility
- Measurability
- Attainability
- Congruency
- Acceptability

Specific

The more specific the objective the easier it is to formulate plans or strategies necessary for attaining it. Objectives should clearly state the desired result and they should specify a time frame for accomplishing it when appropriate. Specific objectives provide planners with useful guidance for plan formulation. Non-specific objectives cannot be effectively pursued or attained and are to be avoided. "Improve the environment" is a non-specific objective that does little to aid planners or decision-makers. "Increase tidal wetlands in the King River vicinity" is specific enough to guide planners in the formulation process.

The objective, though specific, should not specify a level of the desired result. For example, "Increase tidal wetlands in the King River vicinity by 2,000

acres" is not an appropriate objective. Project outputs vary with the nature and size of the alternative plan and are therefore a product of the formulation process.

Flexible

Objectives should be flexible enough to accommodate alternative measures for achieving them as well as to allow alternative levels of results. "Build a floodwall that provides 100-year protection" is the worst kind of objective. First, it states a solution rather than a problem or opportunity thereby eliminating any flexibility in choice of measures to reduce flood damages. Second, it does not allow for any flexibility in determining the level of flood damage reduction. Planners must be cautioned that flexibility in objectives may come at the expense of specificity and the relative merits of the two must be assessed by the planner in light of customer feedback.

Measurable

A good, specific objective can also be measured. *To be measurable an objective must be stated in terms that can be assessed or quantified.* Though it is not necessarily always desirable for the objective to specify the actual measure, the objective should be measurable in some appropriate units¹². A measurable objective is useful to decision-making. If we can measure a plan's contribution to increasing open space we can more easily evaluate its value. Measurability allows us to observe exactly what a plan contributes.

An objective that "enhances community cohesion" is not easily measured. An objective that "limits the number of razed structures" gets at the same objective in a measurable manner.

Attainable

Objectives should provide a challenge to planners but they must also be realistic and attainable. "Restoring the Minnow Creek ecosystem to its natural condition" is an admirable objective that may be popular with the public but it is not realistic in an urban environment, hence it cannot be attained. "Lowering water temperatures in Minnow Creek" is a more attainable objective. Unattainable objectives may do little more than frustrate planners who are simply unable to meet them. Once such a situation arises it may be very difficult to motivate people. Specificity can often make an objective more attainable.

¹² An exception would be where there are thresholds or legal mandates that make specific levels of an output necessary.

Congruent

Ideally, objectives will be congruent with each other. *Congruency means the objectives fit together.* More specifically, attainment of one objective would not preclude the attainment of another. This is not likely to be the case, however, when the problems and opportunities involve any complexity at all. The variety of different and, at times, conflicting viewpoints on the planning area's problems and opportunities virtually assures some incongruencies.

Incongruent objectives can lead to conflict within the planning process. Conscious or unconscious efforts to minimize conflict by eliminating incongruencies among objectives are to be avoided when the incongruent objectives represent legitimate, if conflicting, problems and opportunities. Incongruencies should be avoided whenever they add nothing to the planning process. For example, there is no point to specifying the objectives: "decrease flood damages" and "hold flood damages constant". These conflict for no apparent purpose. On the other hand it may be wholly appropriate to specify the objectives: "increase open space" and "increase regional tax base". In this latter case there may be an incongruency if the former objective would be served by relocating structures from the floodplain and the latter is served by developing the flood plain. Different plans can be formulated to meet incongruent objectives. Conflicting objectives provide the best reason for different alternative plans.

Acceptable

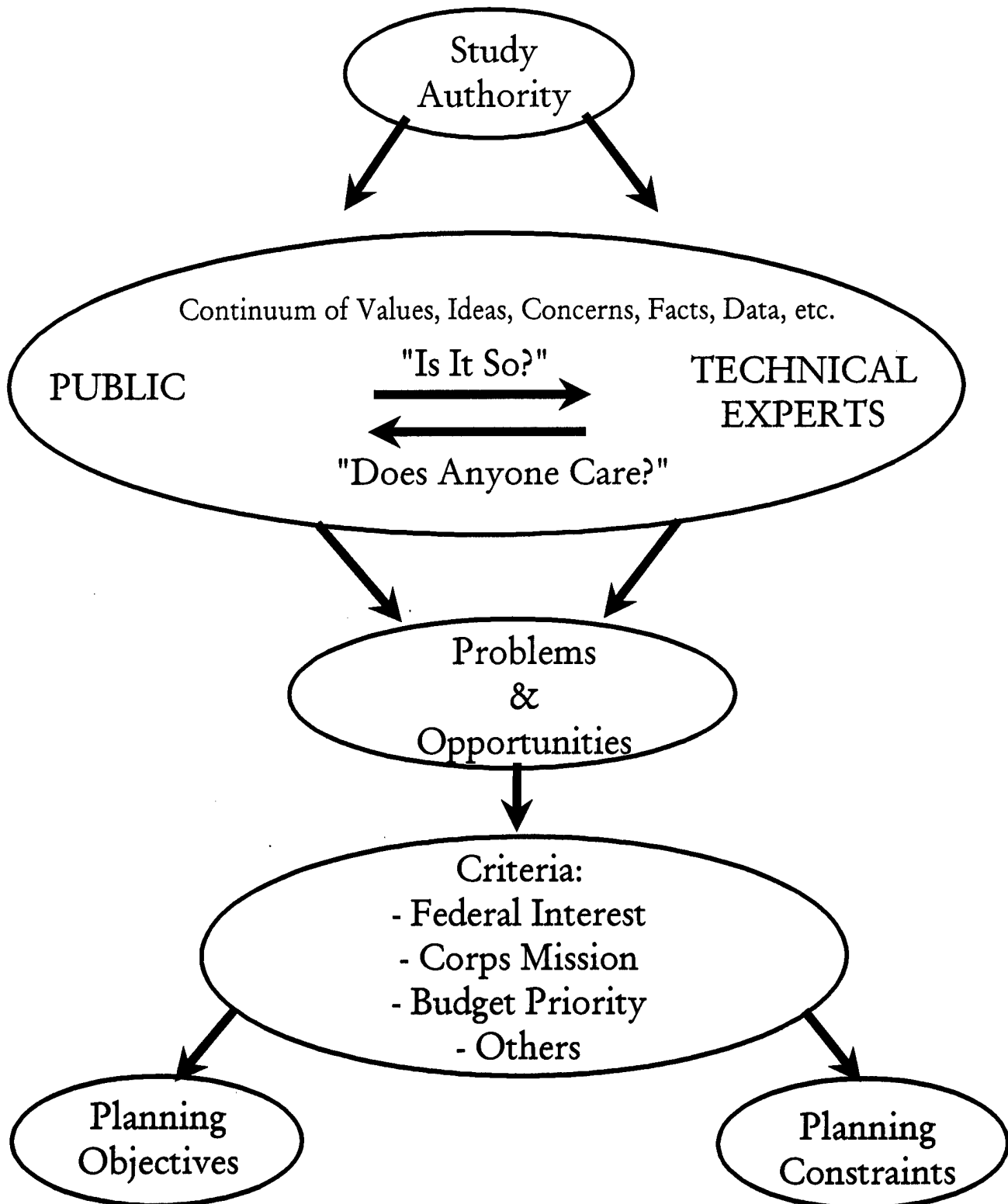
Good objectives have to be acceptable to those responsible for achieving them, i.e., the planning partners. Additionally, they must be acceptable to the partners' customers and major stakeholders. Not every objective must be acceptable to all stakeholders; but, the set of objectives should be acceptable in principle to study interests. If certain stakeholders in the planning process are not likely to subordinate their own objectives to those of the study then acceptability of objectives becomes increasingly important. The specification of acceptable objectives is founded in stakeholders problems and opportunities and there is no better investment in a plan's credibility than paying attention to people's problems and opportunities.

HOW ARE PLANNING OBJECTIVES AND CONSTRAINTS SET?

Figure 8 indicates the essential genesis of planning objectives and constraints. The public raises their concerns. Technical studies confirm whether these ideas and values are accurate and realistic. At the same time technical studies may identify situations that may or may not be of interest to anyone. If a situation exists and someone cares, it is a candidate problem or opportunity. It will be addressed by the study if it passes the appropriate tests.

Figure 8: Where Objectives and Constraints Come From

DRAFT



The tests include things like is the problem covered by the study authority? Is it in the Federal interest? Is it covered by one of the Corps' missions? Are the potential project outputs budget priorities? Do the outputs contribute to national economic development or other significant partnership goals? If the problems and opportunities meet these tests, then planning objectives and constraints are developed to address them.

Key Factors

Although the study team actually specifies the planning objectives they must do so while taking several key factors into account. *First, the partnership's external environment often exerts considerable influence on the objectives.* The external environment comprises all those factors which the partnership cannot control. External stakeholders can influence the planning process by social norms, specific constraints, pressure campaigns, court challenges, direct controls (e.g. resource agencies sometimes have effective veto powers), etc. Thus, setting planning objectives is, in part, a process of establishing a favorable balance of power between the partnership and external environmental factors.

Second, the partnership's resources influence the nature of the objectives. Studies hampered by severe time and money constraints will not be able to address as complete a range of objectives. Plans will consequently be less comprehensive in scope. Non-Federal partners who contribute databases and work in-kind may constrain a study from considering a broader range of objectives. Better funded studies can set more objectives.

The partnership's internal politics and power relationships will influence planning objectives. Planning teams with more overall support of the partners can set more ambitious planning objectives. Innovative planning objectives that do not enjoy the support of higher elements on either side of the partnership may have a more difficult time gaining support.

Finally, the value system of top decision-makers in the partnership affect the specification of planning objectives. In the Corps, annual budget guidance identifies the agencies priorities for the year. Many planners will see no point in deviating from this guidance in setting planning objectives and in so doing they may miss the chance to solve other problems or capitalize on opportunities.

Identifying Planning Objectives in Four Steps

There is no recipe or formula for identifying planning objectives. It is a task easier prescribed than accomplished. If your method works, it's a good one. Bearing in mind who does it, why they do, what a good one is, etc., there are a few activities that would appear to be a necessary part of any effort to identify planning objectives. They're listed in Table 18 and are described briefly below.

Table 18: Steps in Identification of Planning Objectives

- Identify problems and opportunities
- Solicit public views of problems and opportunities
- Analyze problems and opportunities
 - base condition problems and opportunities
 - project future conditions problems and opportunities
 - revise planning area as needed
- Establish planning objectives

Bear in mind, however, this is an iterative process. Though specifying planning objectives early in the planning study is essential in order for planning to proceed, the final set of planning objectives may not be available until rather late in the planning process. Planning objectives, like plans, may require clarification and refinement as additional information comes to light or when it becomes clear some objectives cannot be addressed by the study.

1. Identify Problems and Opportunities

If planning can be considered a process for meeting human wants and needs, then it must begin with an understanding of those wants and needs. In the Corps' lexicon those wants and needs are called problems and opportunities. The study must begin with a clear understanding and statement of what the problems and opportunities of the planning area are. We can't know what to do until we know what people want and need done. **Problem and opportunity statements** are living documents that should be a constant feature of every planning process.

The public plays a key role in identifying the planning area's problems and opportunities...

2. Solicit Public Views of Problems and Opportunities

The public plays a key role in identifying the planning area's problems and opportunities as shown in Table 18. This identification process can involve groups and individuals with many different views of what the problems and opportunities are. It is not likely that there will be unanimous agreement on what the problems are. This makes it all the more essential that some consensus be obtained on the problems and opportunities to be addressed in your study.

A tentative statement of problems and needs can be presented to the public for clarification and refinement. The problems and needs identified should be related to water and related land resource issues but they need not be constrained by the existing authorities of either the Corps or its partner. This public involvement may be obtained formally or informally. Public views are indispensable to an understanding of the issues and their perceived urgency.

Base Condition and Future Expected Annual Damages

Suppose early study activities have identified flooding as a problem in an urban area. Public opinion has established that flooding, especially flood damages to property, are indeed a serious problem. For simplicity, assume the effects of the flooding problem are confined to the town in which they occur.

To describe the base condition for this problem we would normally calculate expected annual damages. This would be done only after substantial data had been collected and analyzed. A risk-based analysis of expected flood damages would result in a distribution of damages that describe the magnitude of the damages that are occurring at the time of the study. By the very nature of this calculation we are assuming that hydrologic and economic conditions that existed at the time our databases were developed extend into the future.

The future condition description of the base condition flood problem, described by expected annual damages, must address likely changes in the hydrology and economic base of the flood plain. There may be alternative future scenarios of upland development that produce very different runoff patterns in the future. Land use and redevelopment plans might exist that could lead to substantial increases or decreases in flood plain development. Capturing all of these possibilities might require several estimates of future expected annual damages. Though one may be regarded as the most probable future damage estimate the others should be estimated too. What is being developed at this point is only a part, but a very important part of the without project condition scenario. If no action is taken, what will expected annual damages in this area be? Problem identification provides the answer.

The very nature of the risk-based flood damage analysis results in a range of results that need to be presented and carefully explained. A distribution of expected annual damages may or may not represent alternative future conditions depending on how it was developed.

Following this step in the process the study team should have a statement of problems and opportunities that reflect the priorities and consensus of the public.

3. Analyze Problems and Opportunities

This task requires some analysis by the study team. There are basically three analytical tasks to be performed. First, the problems and opportunities that can be addressed by the partnership have to be identified. Second, the existing or base condition of these problems must be adequately described. Finally, the study

team must describe the problems and opportunities under projected future conditions.

a. Problems and Opportunities in Relation to Water Resources

The first task is to determine whether the concerns of the public are related to water and related land resources and whether they can be addressed by the Federal/non-Federal partnership. High crime rates near the river, for example, may be a significant issue but it's unlikely this problem can be addressed by the Corps.

What is to be done about problems and opportunities that exceed the current authorities of the partners, especially the Corps? When another entity has an established responsibility for the problem identified it may be possible to involve them in the study process. For example, though crime is well beyond the authority of the Corps' programs it may be possible to solicit police and other public safety agencies input in the design of floodwalls to assure that access through the wall, visibility of pedestrians and minimization of potential hiding places are considered in project design.

In other cases, information about problems or opportunities may be passed on to the appropriate authorities. Suppose, for example, a traffic flow problem is identified during this stage of the study. Even if it is beyond the scope of the water resource study this information can be passed along to the appropriate agency for attention, rather than be ignored because it is beyond the Corps' authority.

In some instances, problems may be water-related but beyond the current authority of the Corps. There are two schools of thought on this. One is to decline involvement in any activities that are beyond the Corps' authority. The other is to look for a way to blend these water resources needs into existing authorities, perhaps stretching and extending them a little. **Acid mine drainage** is an example of a problem over which the Corps has no current authority. New environmental programs and a renewed interest in watershed planning have provided the impetus for at least one district to address this problem. One aspect of watershed planning is to identify issues like these that might require a broader partnership. Bringing other Federal, state and local agencies with an interest in these "new" issues into the partnership can be an effective way to develop more comprehensive plans.

b. Base Condition of Problems and Opportunities

Frequently the public will only be able to give their problems and needs a general form. The study team will have to put a face on the community's problems and needs. *The base condition is a composite description of the problems and needs at the time of the study.* It's the technical verification of public concerns shown in Figure 8.

The public may be capable of defining flooding from a stream as a problem but the study team will have to do some analysis to determine the extent of the flood plain, the frequency and depths of flooding, the properties affected and the expected annual damages under existing conditions.

This step zeroes in on the problems and opportunities identified and should not be confused with the more thorough inventory of resources discussed in the next chapter. It will, however, overlap considerably with that step of the planning process.

c. Forecast Future Conditions Problems and Opportunities

The problems and opportunities the public sees today may be very different in the future. Some problems will get worse, others will go away. Some opportunities come along only once, others improve over time. The third task in the analysis of problems and opportunities is to forecast problems and needs for future conditions. This task overlaps considerably with step two in the planning process.

Future conditions can only be guessed. The guessing may be more or less scientific, more or less credible, but it remains an uncertain guess. A range of alternative future conditions that might affect problems and opportunities in different ways should be identified if different effects are possible. From these possible futures the **most likely future condition** should be identified. This becomes the study team's best guess about the community's problems and needs in the future but alternative futures should not be ignored if they could result in significantly different problem and opportunity definitions.

The identification of the most probable future condition is based on the views of various segments of the public, professional planners involved in the study, projections currently in use, data analysis, and other information sources deemed relevant. Care must be taken to exercise judgment and to avoid naively simple extrapolations of past trends to describe future conditions.

This step is important because it establishes the temporal range and the validity of problems to be addressed in the study. This is an important and critical point of agreement among the customers and the partners. It can be expected to be particularly critical in environmental resources planning where complex, cumulative impacts can lead to very wicked future problems.

4. Establish Planning Objectives

The steps to identify planning objectives are presented sequentially because an orderly approach to the discussion is needed. The actual identification of planning objectives is not quite so orderly. The study

Objectives that cannot be attained should not be included among the array.

Planning Objectives and Constraints

Following is an example of some reasonable planning objectives and constraints adapted from an actual Corps study.

- Problem 1: Declining extent of wetlands ecosystem.
- Objective 1: Increase the total spatial extent of wetlands.
- Objective 2: Reestablish relative balance among lost historic plant, fish, and wildlife communities.
- Constraint 1: Protect threatened and endangered species.

- Problem 2: Continuing flood damages.
- Objective 3: Reduce flood damages on tribal lands.
- Constraint 2: Minimize loss of flood protection from existing flood damage reduction projects.

- Opportunity 1: Improve water supply.
- Objective 4: Restore more natural water quality.
- Constraint 3: Meet state water quality standards.

In this example, adapted from a Corps study, the objectives and constraints are directly associated with a problem or opportunity statement. The report text that follows a statement like this can then expand on each objective or constraint as necessary.

team may begin specifying objectives when they first see the study area. We want the planning professionals to have ideas and reactions from day one. We don't want those ideas to become crystallized and finalized, however, until all the work described above is done.

Nonetheless, the team will begin with some very preliminary notions of planning objectives. As problem identification proceeds these objectives will change. When public feedback on problems and opportunities is sought, more refinement and clarification will follow. As analysis begins to give dimension to the problems more specific objectives can be fashioned. As the study progresses through the various iterations of the steps of the planning process further refinements may be necessary. If your notion of specifying planning objectives is a team meeting where the doors are closed and the objectives are set once and for all, dispel that notion. That exercise may be a very useful starting point, but specifying objectives is an iterative process.

The final step in identifying planning objectives is the establishment or specification of planning objectives. Early in the planning study, objectives may be very general in nature. As planning progresses and becomes more refined the objectives should be continuously reexamined so that a limited number of very specific objectives are identified and used to develop alternative plans.

Scoping a Planning Objective

Planning objectives are specified in an iterative process. We begin with broad and general objectives and proceed through a scoping process to project-specific planning objectives.

Suppose Congress has authorized a flood damage reduction study. As we begin the study we know one planning goal will be to enhance national economic development. Relying solely on the P&G definition of this goal we could specify several general planning objectives as follows:

- 1) Increase the value of goods and services produced on the floodplain.
- 2) Increase the value of output resulting from external economies associated with flood plain activities.
- 3) Minimize the costs of flood damage reduction.

At this early point in the study these are vague but perfectly reasonable statements of what we want our plan to produce. As the study progresses and our understanding of the problems grows, the objectives become more specific. After further refinement, the actual planning objectives may be:

- 1) Reduce expected annual damages in Willow.
- 2) Reduce flood-related traffic disruption on Highway 13.
- 3) Minimize flood-related disruptions of businesses in the flood-free portions of Chiclay County.

During the course of the study, objectives can be expected to proceed from the general to the specific. Unless otherwise specified it should be assumed that the period of analysis is the appropriate time frame for meeting the objectives. Constraints may evolve in a similar fashion.

The final array of objectives must be specific enough to insure that all reasonable alternative means of meeting them can be examined in the study. Objectives that cannot be attained should not be included among the array. Planning objectives should be related to specific problems or opportunities.

The planning objectives must be shown to your customers and publics so you can obtain a consensus agreement on what your planning study will try to accomplish. The planning objectives are your mission statement. Agreement with and general support of this mission statement is critical to the study's success.

OBJECTIVES NEVER CONTAIN MEASURES

Problem statements should not include solutions and neither should planning objectives. An objective that says "Build a floodwall around Willow", has

violated the intent of the planning process. If we are to seek optimal solutions that meet the NED planning goal and as many of the planning objectives as possible, we cannot begin by ignoring the full range of measures available to us. Planning objectives should not specify the measures or strategies that can be used to meet the objective. Thus, unlike a for-profit business, planning goals should not specify a precise level of objective attainment or a specific measure for attaining it.

Figure 9 presents some typical planning objectives in general form and some measures used to achieve those objectives. The measures must never appear in an objective.

WHAT DO YOU DO WITH PLANNING OBJECTIVES AND CONSTRAINTS?

Use them!

SUMMARY AND LOOK FORWARD

Lesson one. Planning studies are iterative processes. Although you may be able to identify discrete steps in the planning process, the reality is that there is considerable overlap in the timing and content of the steps. It is not really clear where one step ends and the next one begins. If there is not someone to say, "Time is up, pencils down, turn in your papers", studies might go on forever. There is always more to know.

Lesson Two. The study begins with an identification of an area's problems and opportunities. The partners, their customers and publics provide the information needed to develop a consensus agreement on the problems and opportunities to be considered in a study.

Lesson Three. Planning objectives and constraints may be a whole lot more important than you ever imagined. They are inspired by the description of existing and forecasted problems and needs of the planning area over a considerable period of time. The objectives specify what the plan intends to do. Constraints describe what the plans shouldn't do. They are, in a sense, the mission statement of the partnership. Without the list of planning objectives it is impossible to formulate plans. Without the list of planning objectives it is impossible to evaluate plans. Without the list of planning objectives it is impossible to select a plan. If you get the planning objectives wrong, the formulation, evaluation and selection will be wrong. The choice of planning objectives determines to a significant degree the success of a planning study.

Figure 9: Objectives & Measures

DRAFT

Objective	Measures
Reduce flood damage	Floodplain management; zoning Relocation Reservoir storage Levees; floodwalls; channel improvement Drainage; detention basins Soil conservation; erosion control Watershed management Conventional hydropower plant storage Run-of-river conventional plant Pumped storage Tidal power Natural surface water Storage surface water Groundwater Desalination Pumping from coastal aquifers Sources above Land reclamation & drainage Improved irrigation practice Salinity control Temperature control of storage releases Low-flow augmentation Dredging channels Stabilizing and rectifying channels Canalization Flow augmentation Port and harbor improvements intermodal transportation Streamflow augmentation Restrict polluted discharges Reuse of waste & irrigation water Groundwater recharge Fish ladders Fish hatcheries, fish stocking Protect water intakes Control water temperatures Improve spawning areas Preserve wildlife habitat Improve wildlife habitat Stream recreation Nature area recreation Preserve wild & scenic rivers Salvage programs Evaluation & analysis programs Public display, interpretative programs Improved water quality Control disease vectors Improve nutrition (irrigation) Reduce flood hazards
Provide hydroelectric power	
Provide reliable water supply	
Provide reliable agricultural water supply	
Provide for waterborne transportation	
Improve water quality	
Mitigate fish and wildlife impacts	
Increase recreation	
Protect cultural resources	
Assure public health & safety	

The next chapter describes the second step of the planning process, the inventory of resources and the without project condition description. This step establishes a benchmark for comparison of all alternative plan effects.

CHAPTER SEVEN: STEP TWO - INVENTORY AND FORECAST RESOURCES

FUTURE, n. THAT PERIOD OF TIME IN WHICH OUR AFFAIRS PROSPER, OUR FRIENDS ARE TRUE AND OUR HAPPINESS IS ASSURED. AMBROSE BIERCE, *THE DEVIL'S DICTIONARY*.

STEP TWO: "INVENTORY, FORECAST, AND ANALYSIS OF WATER AND RELATED LAND RESOURCE CONDITIONS WITHIN THE PLANNING AREA RELEVANT TO THE IDENTIFIED PROBLEMS AND OPPORTUNITIES." (P&G STANDARDS SECTION III PARAGRAPH 1.3.2 (A)(2))

INTRODUCTION

The "without project condition" is universally regarded as the keystone to the evaluation, appraisal, and comparison of alternative plans. No single element of the planning process is more critical to these steps of the planning process than this forecast of the most likely future that will exist in the study area in the absence of one of the planning alternatives. The inventory, forecast, and analysis of conditions in the study area are the step two tasks necessary to develop the without project condition.

A common criticism of the Corps' planning process, in essence if not in actual fact, is that too many planners adhere to Mr. Bierce's definition of the future, where everything turns out exactly as we would like. The implication is that without project conditions are, at times, manipulated so that they support an evaluation that leads to the selection of a plan that was somehow identified as the desired course of action long before the planning process was completed.

This chapter addresses the second step in the planning process. In this step, planners need to ask themselves, "What information do we need to determine whether and how well we are meeting our planning objectives?" The principle outcomes of this step are the description of existing baseline conditions and the development of a most likely without project description. This so-called "without condition" is a detailed description of the future situation society will have to forego if a plan is implemented. The without condition does not preclude, in fact it requires, consideration of any and all actions that will most likely be taken in the future if one of the partnership's plans is not implemented.

To produce these outcomes you don't just go out and start collecting data. You need to develop a strategy so you collect only the data you need and all the data you need to get the information required to do good planning and make good decisions. This chapter begins with the single notion that planning requires

With and Without is not Before and After

"Before storm protection was built in the coastal town of Amity in 1960 there was little economic activity. Now there is a \$1 billion tourist industry," says the mayor in a tribute to the artificial dunes. The implication is clear. The dunes have caused a tremendous economic growth. But, did they?

Suppose the mayor forgot to mention that a bridge replaced the five-car ferry in 1965. Population within two-hours of the town has more than doubled and personal income has tripled. In addition a very successful advertising campaign attracts visitors from 15 states. Would it still be fair to attribute the economic growth to the dunes? These other changes would have taken place anyway.

The mayor provides an example of a before and after analysis that measures a variable, economic activity, at one point in time and again at a later point in time. There is no cause and effect analysis. A without and with project condition introduces cause and effect analysis to these comparisons over time.

information, before it considers the generic types of information needed. It is here that data collection parameters and an information gathering strategy are described.

A distinction is made between information about things beyond the partnership's control and things they can control. Only then do we return to the existing and without project conditions descriptions.

PLANNING REQUIRES INFORMATION

Planning was defined in Chapter Two as the deliberate social or organizational activity of developing an optimal strategy for solving problems and achieving a desired set of goals. That requires information. Data contain information. *Data collection is not the task of this second step in the planning process, information gathering and management is.* Data collection is a means to an end, not an end.

A common mistake in this step of the planning process is to look at a previous study that has successfully moved through the system and use it as a template. If that contained a table with the number of houses in each township since 1900,

then this plan will too. The data collected are often the data that are available. Reports can be loaded with reams of tables and figures with fantastic arrays of numbers and other data. Unless these data become information that help the planning process, time and money were wasted in collecting them and they simply take up space in the report. In a planning world faced with lean budgets and wicked problems, that is a luxury no one can afford.

Data are passive. For example, vast arrays of numbers simply exist. *The data become information when someone effectively communicates what it is the data reveal about the world in which we live that is important for us to know. Data collection, in and of itself, should never be the goal. The only reason to collect data is to retrieve the information they hold that is needed to explain the actions you are taking, the problems you are solving, the goals you are trying to achieve.*

Unless these data become information...time and money were wasted in collecting them and they simply take up space in the report.

Information is the resource used to identify problems and opportunities, to specify planning objectives, to formulate plans. Information is the vehicle used to communicate the relative merits of alternative plans. Information is the goal of this step.

Information is needed in each step of the planning process. What distinguishes this step is the type of information that is needed. *The inventory requires the collection of enough information to adequately, not necessarily completely, describe the conditions that exist in the planning area at the time of the study.* The interrelated planning steps can be seen here. Step one is to identify problems and opportunities and translate them into a set of planning objectives that becomes the partnership's mission statement. That can't be done without information about existing conditions. The steps are inextricably bound to one another.

The forecast requires information about conditions that will prevail over the next 50 years or so if the partnership takes no direct action. This development of a without project condition is an exercise in uncertainty. **With project conditions** will be described in an analogous fashion but, strictly speaking, they are not part of this step because well defined alternative plans will not yet have been formulated during the first iteration of Step 2.

WHAT KINDS OF INFORMATION ARE NEEDED?

Look at the problems, what do you need to describe them?

Despite the title, you'll find no specific answers to that question here. *Look at the problems, what do you need to describe them adequately? Look at the opportunities, what do you need to describe them?* Look at your planning objectives, what kind of information are you going to need to know if you're meeting them and to what extent you're meeting them? Think about your stakeholders, what kind of information are you going to need to tell them the story of what you did?

The planning objectives were offered as a unifying concept in the last chapter. They are the sole reason for the existence of this Federal/non-Federal partnership. As such, they provide a good focal point for information gathering. *What kind of information are you going to need to determine whether you are contributing to the achievement of the planning objectives?* What quantity and quality of information are you going to need to convincingly say how much you are contributing to each objective? Answer those questions and you now have a pretty good idea what kind of information you'll need to satisfy the requirements of this planning step.

Each planning objective should relate to one or more problems or opportunities. What kind of information do you need to adequately describe, the problem/opportunity now and in the future if we take no action as a result of this partnership? Will the problem get better or worse? Will the opportunity disappear or persist? What kind of information will you need to determine the extent to

which problems are solved and opportunities met in the future by actions of those outside the partnership?

"Planner as storyteller" is a helpful role to assume when thinking about the data you will need. You can have the best study team in the world, filled with the finest analysts there are. You can do the best job of planning imaginable, but if you cannot explain what you did and why you did it to

If you cannot tell a complete, logical and easy-to-follow story about what you did...then you cannot plan.

diverse groups of stakeholders it will all be for naught. Once, a plan may have only had to have been understandable to the design engineers and construction team. Planning is far more complex today. If you cannot tell a complete, logical and easy-to-follow story about what you did, bolstered and supported with the information necessary to do so, then you cannot plan.

What kind of information will you need to tell a convincing story about why you made the decisions you made? But, if you're not supposed to start the planning process with the answer, then how can you possibly know what information you'll need to tell your story when your story has not been completed?

As the planning process develops, a story does unfold. That is the story you are going to have to be able to tell convincingly if stakeholders are to believe in the soundness of your decision and the rationality of the process by which you arrived at it. Because you need to guess at the information you'll need at the end from the very beginning, it is inevitable that you'll gather some information that is ultimately not useful (then don't use it!). Likewise, you'll find yourself needing information you don't have (then go get it or work around it the best you can). Revising information needs as your understanding of the problems and opportunities evolves and as planning objectives are refined and the story develops is a constant in every planning study. Planning is an iterative process. That includes step two.

Four Parameters of Data Collection

The four parameters of data collection are quantity, quality, timing and location. How much information do you want/need? How accurate and how representative must the data be? At what point does the collection process start, how long do you have to collect information and for what period of time are data required? What geographic area is to be covered? As the study begins you'll have a preliminary response to these questions. The definitive answer to these questions won't be known until the end of the study. Like virtually everything else in the study process, data collection is an iterative process.

Quantity. Table 19 lists some generic types of data that might be useful for planning. The data types are divided in two broad categories. The first includes **physical data**. These are the data that depend only on the existing physical environment. The second type includes those data that depend on the human element in the environment, **socioeconomic data**. The scope of the study determines which data are applicable and the study stage determines the quantity of data required.

Table 19: Selected Data for Planning

I. Physical	II. Socioeconomic
A. Geology	A. Institutions
1. Formations	1. Water-related
2. Foundation characteristics	2. Political
3. Minerals	3. Regulatory
B. Land Resources	B. Demographic
1. Soil survey (land classification)	1. Population (existing & future)
2. Development	2. Population characteristics
3. Drainage	3. Location of population
C. Hydrogeology (Groundwater)	C. Geographical, Social
1. Aquifer characteristics	1. Land use (existing & future)
2. Yields	2. Values and elevations
3. GW elevations (records)	3. Zoning
D. Physical Geography	D. Economic
1. Maps	1. Markets
2. Aerial photographs	2. Income Distribution/ Employment
3. Infrastructure (cities, roads, etc.)	3. Benefits and cost estimates
E. Meteorology	E. Financial
1. Rain gages	1. Sources of funds
2. Precipitation records	2. Types of repayment
3. Evaporation and evapotranspiration	3. Cost-sharing and allocation
F. Hydrology	F. Legal
1. Gaging stations, location	1. Water law
2. Stream flow records	2. Environmental laws
3. Watershed characteristics	3. Agreements, treaties, constraints
G. Water Quality	G. Social Publics
1. Groundwater and surface water quality	1. Stakeholders
2. Sensitive areas	2. Silent majority
3. Sediment loads	3. Disseminating information
H. Environment (Ecology)	H. Other Sectors/Functions
1. Flora and fauna	1. Agencies for coordination
2. Sensitive areas and significant resources	2. Plans (cooperation)
3. Air, land, water pollution	I. Recreational Needs

Source: Adapted from Helweg, Otto J., *Water Resources Planning and Management*

Quality. The quality of data depends primarily on the stage and type of the study. For a continuing authority program a visual inspection of a stream may be adequate. For a feasibility study the stream may need to be gaged. Data should be **homogeneous**, i.e., they must measure one thing consistently. They should also be representative. The data set should be an **unbiased sample** from the population of interest. For example, a short stream record taken during unusually wet years would not be representative of the long-term stream flows. **Accuracy** is a fundamental aspect of data quality. The accuracy of your data must be known and communicated in the report.

Information: Existing and Future

Suppose one objective is to reduce flood damages in the Minion Creek Township. What might you need to do that? First, keep in mind this is a planning objective and at this step in the planning process we have two tasks. First, we need to establish the nature of the existing flood problem. That will require existing hydrology and hydraulics as well as information about the potential damages in the flood plain.

Second, we need to establish a most likely future scenario if we do not implement any plans. That will require an analysis of future hydrology, hydraulics and floodplain development. It would also have to include consideration of any potential activities that might be taken by others to lessen flood damages in the future without a plan.

If another objective is to preserve wetlands and natural flow easements in the area, this will require additional data. Although hydrologic requirements might overlap the two objectives it will be necessary to document the amount and quality of existing wetlands and flow areas. In addition, it will be important to identify activities that could either diminish or increase these resources in the future.

The careful specification of a comprehensive set of planning objectives can help assure that environmental and other non-NED values are addressed adequately in the information gathering process.

What about the information you need to determine how much flood damage each alternative plan reduces or increases and how much wetland they affect? These kinds of information are gathered in much the same way. These information gathering tasks are really part of a later step (four) in the planning process. As we have and will continue to stress throughout this manual, it's not possible to separate the process into discrete steps. The process is a cobbled one of continuous overlap, iteration, and activity bordering on chaos that returns as necessary to the infrastructure of a rational planning process.

Timing. There are two dimensions to the timing characteristic of data collection. First, is time as it relates to the planner. When can data collection begin and how long do you have to complete the study? These dates and periods vary with the type and stage of study. Planners know every question has the one hour answer, the one day answer, the one week answer, etc. The length of time allowed to gather information depends on the importance of the information.

Second, is time as it relates to the data itself. The dates on which data were collected may be important. Streamflow or water quality data collected during a drought may differ substantially from normal data. Economic surveys conducted during recessions will differ from those collected during economic booms. Another aspect of data timing is the length of the data record. This is especially important for hydrology and monitoring the health of ecosystems.

Location. The geographic area for which data are collected will normally conform to the study's affected area or the planning area. Normally data will not be collected for areas outside the affected area unless the outside data affect the study or are needed to provide perspective and context for the study area data.

The section below offers a method for developing an information gathering strategy. When planning to collect data to provide the information necessary for good decision-making, planners must be cognizant of the quantity, quality, timing and locational dimensions of their data collection efforts.

Preparing an Information Strategy

If you have prepared a list of planning objectives, then you have an invaluable input for determining your information needs. Beneath each statement of a problem list the types of information you'll need to describe the problem. Then, you can list the types of data you are going to need to provide the information you require.

Table 20 provides an example of how this information strategy might be arranged. The numbered items indicate the basic information sought. The lettered items identify data that will help provide that information. Obviously, the analysts can provide as much detail as is required or desired in describing the information needed and the data that will provide that information. **An information gathering strategy** like this should be prepared for each planning objective. In subsequent steps, as alternative plans are identified, additional information may be required for evaluating, appraising and comparing plan impacts. However, if you do a good job in this step, most of that data will already be available.

In many cases, data collection emulates the data collected in another recent successful plan. Planners who collect information in this fashion run the risk of

Table 20: Information Gathering Strategy**Problem 1: Flood damages from Minion Creek****Information Needs:**

1. Definition/extent of flood plain
 - a. Topographic maps: obtain existing aerials
 - b. Hydrology - existing & future: USGS gage data
 - c. Hydraulics - existing & future: field surveys
2. Property at risk of flooding
 - a. Property survey - existing & future: field surveys
 - b. Appraise value of property: Marshall-Swift
 - c. Depth-damage curves: FIA curves
3. Expected annual damage estimates - existing & future
 - a. Frequency curve: H&H section
 - b. Rating curve: H&H section
 - c. Damage curve: Economics Branch
 - d. Estimating algorithm or computer program: SID EAD
4. Likelihood of restoration of natural flood plain values
 - a. Residents views on evacuation: public involvement
 - b. Environmental resources restored: expert opinion
 - c. Political support: study coordination

wasting scarce study resources collecting data that are not going to provide useful or necessary information. More importantly, they may overlook necessary data and information unique to their own planning situation. The amount and types of information that can be gathered are virtually limitless, but not all of that information is going to be of equal value in decision-making. *The cardinal rule for information gathering is to get what you need to make good decisions, not what is available.*

Once the data needs for each planning objective have been tentatively identified, the planner needs a strategy for obtaining the data and information. This begins by identifying generic sources of information as shown in Table 21.

Table 21: General Sources of Data

1. Internal secondary sources
2. External secondary sources
3. Internal primary sources
4. External primary sources

Internal data are data produced by the partnership. What data do you already have? **External data** are data produced by institutions, agencies, individuals, and organizations that are not part of the partnership. What data has already been collected by others?

Secondary data has already been gathered for some other purpose. **Primary data** are obtained from original research. An example, of external primary data would be stream gage data collected by the U.S. Geologic Survey.

Let the Planner Beware

The without project condition makes it possible to describe what society is going to have to give up in order to gain the outputs of an alternative plan. In order to properly describe what is going to be lost, it is important that the existing condition and forecasts include all resources of significance. If problems, opportunities, and planning objectives are properly identified, this should assure that all resources of importance are included. However, planners should review the planning area to assure this has been done.

For example, suppose a study area has some bottom land hardwoods and wetlands. Inexperienced planners might fail to realize the plan has an opportunity to preserve and enhance these valuable resources, in which case they could be overlooked in the information gathering steps. Thus, we offer as a caveat the admonishment that if you have significant resources in a planning area that do not show up in a problem or opportunity statement, or that are not mentioned in a planning objective, you need to reconsider your step one activities; you may have missed an opportunity.

External secondary data would include the census data collected by government. Internal secondary data would include information in previous studies. Internal primary data would include things like original surveys of all types, foundation explorations, interviews, etc.

The information gathering strategy can be expanded as was shown in Table 21 to indicate the general source of the data. This entire step is nothing more than an update and more specific iteration of the work that was done in the preparation of the Project Study Plan.

What Types of Information Are Typically Needed?

There are many lists of specific data types or sources that might contain the information needed to conduct a successful study beyond that of Table 20. They can generally be found in guidance and the professional literature. We avoid them here because it is more important to realize that there is no such thing as a typical study anymore. Even the old "typical studies" were never really typical. They almost always involved unique and wicked problems. Nonetheless, there are many useful lists that can be found in the NED benefit procedures

manuals produced by the Institute for Water Resources. Additional and excellent sources can be found in the Corps' ECs and ERs. These are typically classified by organizational function, e.g., planning has its guidance and engineering has its guidance. Those interested in lists of representative or essential information types are advised to review the more detailed guidance. What we'd like to say in this manual about the information needed is more general in scope.

EXTERNAL AND INTERNAL ENVIRONMENT OF THE PARTNERSHIP

Many factors that affect a plan are external to the planning process. These are the things that cannot be controlled or influenced by the partners. They include economic, governmental, political, social, natural and technological factors or

trends that are beyond the influence of the planning process, but that might influence the planning area directly or indirectly, now or in the future.

There are also internal factors, elements and systems that exist within the sphere of influence of the partnership. These would include all the institutional elements and systems of the partners themselves plus those factors of the planning area that can be affected and influenced by alternative plans.

EXTERNAL ENVIRONMENT

The **external environment** is sometimes called the **macroenvironment** by private sector firms engaged in strategic planning. It is important to think about macroenvironmental factors when determining what information is going to be needed to inventory and forecast resources for your study. Table 22 provides some examples of these factors.

Table 22: Examples of Macroenvironmental Factors

- | | |
|---|--|
| <ul style="list-style-type: none"> • Economic <ul style="list-style-type: none"> - Business cycle - Money supply - GNP trends - Inflation - Interest rates - Exchange rates - Unemployment - Balance of trade • Government & Politics <ul style="list-style-type: none"> - Environmental laws - Attitudes toward government - Tax laws - Stability - Trade policies - Alliances - Wars & conflicts - Election results | <ul style="list-style-type: none"> • Societal <ul style="list-style-type: none"> - Quality of life attitudes - Lifestyles - Women in work force - Career expectations - Population growth - Crime - Education trends • Natural <ul style="list-style-type: none"> - Pollution - Climate change - Resource reserves • Technological <ul style="list-style-type: none"> - R&D spending - New products - Technology transfer - Automation & Robotics - Patent laws - Spread of technology |
|---|--|

The fall of communism provides a dramatic example of an external event that has had enormous implications for the world. During step two, planners should be scanning the horizons of the future looking for the dramatic changes that could affect their plans. They need not be "fall of communism" magnitude, but no reasonably foreseeable significant change should be overlooked.

Future External Environment

What is going to happen to that tidal wetland if we do not implement a plan? Will it be filled and developed for condominiums and a shopping center or will it be protected from such uses? That depends on many things. If we can show these wetlands were going to disappear anyway then there is not a significant impact if one of our alternatives would cause their loss, is there?

If there are no legislative restrictions the future of the wetlands may depend on the state of the economy in this area and population growth; which may in turn depend on the quality of life in the area. Perhaps, if the education system is not improved in this county people will continue to try to escape the poverty that results and the land will never develop anyway.

Suppose there is national legislation that prohibits the development of tidal wetlands. Suppose even in the absence of national legislation we see this state moving toward a more environmentally friendly stance. There could be many factors well beyond the partnership's control that would affect our forecasts of future conditions without a plan. It is the planner's job to consider them adequately and as objectively as possible.

In order to define a good without project condition, planners must develop some facility in looking into the future. Deep draft navigation has to be concerned about future trade patterns and trends in energy prices, etc. These are factors clearly beyond the control of planners, but they are factors clearly of importance to planners. The fall of communism will open markets formally closed to U.S. commerce. What will this mean for commodity forecasts and future tonnage? If relations between the U.S. and Cuba are normalized what will this mean for ports in south Florida?

These are questions with important implications for projects. *A major purpose for considering these external or macroenvironmental factors is to try to identify trends, factors, and events that could affect plan outcomes in a significant fashion.* In many cases, information will be incomplete and speculative. In such cases it may be prudent to define more than one without project condition. For example, a south Florida port project may be well advised to have a without project condition that includes a "closed Cuba" scenario and another with an "open Cuba" scenario because project benefits may vary greatly between the two scenarios. The choice of the most likely scenario will depend greatly on information gathered during this step of the planning process.

A common error in forecasting future scenarios is failure to consider foreseeable changes and trends in the macroenvironment. It's the planner's job, to the extent possible, to identify any future events that could significantly alter the outcomes of a plan and to give them appropriate and explicit consideration. A common

characteristic of particularly good plans is that ability to consider important things that are not so easy to foresee.

INTERNAL ENVIRONMENT

The **internal environment** is what is commonly considered within the domain of a Corps study. Here, we use the term internal to mean internal to the study process. This information includes the hydrologic, hydraulic, environmental, economic, engineering, and other data and information that are the bread and butter of a Corps study. These are the kinds of data primarily referred to in the information strategy example above. These data will always be critical to Corps studies. Enough has been said about them in other Corps guidance, however, and they are not addressed further here.

RECOGNIZE THE UNCERTAINTY IN WHAT YOU ARE DOING

Acknowledge the uncertainty inherent in what you are doing. A little humility will go a long way in this step of the planning process. Describing existing conditions is a daunting task. There is so much information that could be gathered and there are so many stakeholders with their own interests and agendas, that it is virtually assured that you will not have all the information necessary to satisfy all these people. Admit that from the outset. Explain what you collected and why you collected it.

Describing future conditions is even more problematic. In this step you are asked to forecast conditions for the variables, elements and systems identified in your information gathering strategy. No one expects you to foresee the future with perfect clarity, but everyone will expect you to see what, after the fact, everyone claims was obvious.

MULTIPLE ALTERNATIVE FUTURES

If there are reasonably possible alternative futures that could presumably lead to different planning results, use more than one and involve stakeholders in the process. Different results can mean significantly different plan impacts or even a different decision regarding the scale or choice of a plan. Use each scenario. Handicap the differences. Weight them if you have to, but use them. It is preferable in the planning process to admit to the vulnerability of uncertainty than to rely on the tyranny of unwarranted certainty.

Partners must be honest with one another. Customers expect honesty in their products, citizens deserve honesty in government. Uncertainty is a fact of life and both Corps' customers and partners can handle that as long as the uncertainty is described honestly, openly and in a straightforward manner.

EXISTING CONDITIONS

A specific outcome of this planning step is a definition of existing conditions. Existing conditions is defined as the condition of resources, problems and opportunities at the time the study is undertaken. The purpose of this definition of existing conditions is to provide a platform from which forecasts of future conditions without a project can be made. The description of existing conditions should not be confused with either without and with condition scenarios or the no action alternative.

On occasion, conditions at the time the study is undertaken will differ from conditions in the near term future. For example, conditions at the time of study may differ from conditions that will exist in the base year. When this happens, it may be convenient to use base year conditions for the existing condition description because the base year is the most common temporal benchmark for a study. This would be appropriate if there is virtual certainty that yet unrealized conditions will become fact and if the basis for the existing condition is described.

Another example of short-term perturbations in existing conditions may be the temporary effect of a planning study on some resources. For example, rumors that houses will be razed as part of a study could depress real estate values for some properties until accurate information is obtained by the entire public. When such distortions are suspected, conditions that would prevail under full information may be more appropriate to use.

HOW TO FORECAST

Suppose you have done an extraordinary job in identifying and gathering the information you need to describe the existing conditions in the study area. Further suppose you have identified the variables, conditions, elements and systems that need to be forecast in order to describe alternative future conditions. There is still the considerable task of making those forecasts. How do you do that?

To develop plans for a community or region we need to predict the type of environment they'll be facing in the short- and long-terms. *The purpose of forecasting is to identify patterns in natural systems and human behavior and to discover relationships among variables and systems so we can estimate the timing, nature and magnitude of changes in future conditions.*

Though many taxonomies of forecasting methods could be used, we'll rely on three major categories as shown in Table 23 taken from Wheelwright's book *Forecasting Methods for Management*. **Judgmental methods** are the most common. These forecasts include individual judgments, committee or team decisions, and other forms of professional opinion.

Table 23: Forecasting Methods

Approaches to Forecasting	Selected Groups of Forecasting Methods	Major Forecasting Methods
Judgmental	Individual Judgment	Intuitive Ad hoc Multiple attribute decision-making
	Group	Committees Sales force estimates Juries of expert opinion
	Aggregates	Anticipatory surveys Market research
Quantitative	Time Series	Naive Decomposition Simple time series Advanced time series
	Explanatory	Simple regression Multiple regression Econometric methods Multivariate methods
	Monitoring	Tracking signals
Technological	Extrapolation	Delphi Trend extrapolations Morphological research Systems dynamics
	Normative	Cross impact PATTERN La Prospective

Quantitative methods are the subject of most of the forecasting literature, three subcategories are identified. **Time series methods** forecast future events based on historical patterns. **Explanatory methods** attempt to identify cause and effect relationships among variables in the past. These relationships are then used to forecast future outcomes. **Monitoring methods** are relatively new. They seek to identify changes in patterns and relationships to make forecasts when extrapolation of past patterns or relationships is not appropriate. Such methods may be particularly useful in environmental planning where systems are poorly understood because of their complexity or lack of data.

The third forecasting category includes **technological methods**. These methods address long-term issues of a technological, societal, economic, or political nature. There are two subcategories. **Extrapolative methods** use historical

patterns and relationships as a basis for forecasts. **Normative methods** rely on objectives, goals and desired outcomes as a basis for forecasting.

Details of these and other forecasting methods can be found in the considerable forecasting literature. Texts and articles are available on each of the major forecasting methods shown in the table. There are considerably more techniques in use, however. A 1975 IWR report, *Handbook of Forecasting Techniques* and its appendix *Part II Description of 31 Techniques* remains a good source document.

When data exist, time series and explanatory methods will generally be the most useful techniques. These are the best covered in the literature. Courses in these techniques are available at any university. When faced with unique situations or situations in which data are unavailable, judgment and technological methods will dominate. There are any number of specific techniques that comprise the major forecasting methods shown in the table. For example, subjective probability elicitations and nominal group methods are two examples of juries of expert opinion. Consult the *Forecasting Handbook* for details on specific forecasting methods.

*...we look into our crystal ball
and try to describe the most
important aspects of life...*

THE WITHOUT PROJECT CONDITION

This chapter began with the without project condition. It cannot end until we consider it in a bit more detail. In this second step of the planning process we look into our crystal ball and try to describe the most important aspects of life in the planning area over the next several decades. This forecast is based on an existing condition in which we adequately describe those most important aspects of life related to our study authorization.

Our forecasting efforts build upon that base condition. Using a variety of forecasting techniques, we paint one or more pictures of what the future might look like. From the alternative future conditions we select one as the most likely future condition.

This most likely future condition is not necessarily the only possible future condition but it does become our baseline picture of the future. *When we consider how our alternative plans will alter the future we are always comparing alternate future conditions with different plans in place to our baseline condition which is called the without project condition or simply the without condition.*

Other possible futures without a plan in place may be considered in a sensitivity analysis. If we have selected a plan that looks "best" under all forecasted futures then we can be confident we have the best plan. If the "best" plan varies with the forecasted future without a plan in place, then decision-makers must be apprised of the differences and their implications.

Every plan is compared to the same without project condition.

The plan evaluation, comparison and selection are essentially formal steps that say, if we do not implement any plan, here is what the future is most likely to look like. If, however, we implement Plan A, the most likely future looks somewhat different. With Plan B it is different again. Planners identify and quantify the explicit differences among plans (to anticipate a future chapter this is called evaluation) and make some judgments about their relative merits (appraisal and comparison) before a decision is made (selection). Every plan is compared to the same without project condition.

Think of the future in the study area without any plans, i.e., the no action alternative, as producing a mix of good and bad results. We have a pile of good things that will happen (dogwoods in spring, jobs, fishing, etc.) and a pile of bad things (pollution, flood damages, erosion, etc.). Conceptually, we estimate the most important good and bad things related to our study over the planning horizon and pile them up.

We do the same for each of the plans we formulate. The piles without a plan and with a plan can differ in many ways. The size of the piles may be different. There may be more or less good things with the plan. There may be more or less bad things. In addition to different sizes, the piles are likely to have different compositions. The beautiful dogwoods in spring may be gone now, sacrificed to levees that reduce flood damages. Thus, the future good pile has fewer dogwoods but the future bad pile has less flood damage.

The image of the piles helps us understand the conceptual trade-offs society faces. If a plan diminishes or changes the pile of good things the without condition produces then these are things that society loses as a result of the plan. They are costs to society. If the pile of bad things gets smaller, that's a benefit to society. The plan will of course add good things (additional benefits to society) at the cost of some bad things (additional costs to society). Thus, beneficial plan impacts come from the elimination of "bad" things in the without condition scenario or the addition of "good" things in the with project condition. Negative plan impacts come from the elimination of good things under the without condition scenario and the increase in bad things from the with plan condition.

The decision-makers' difficult task is to decide which piles are better to have, the without condition or one of the with condition piles. That decision can't be made based solely on size, because we have not addressed the all important question of the value that society places on the things in each pile. The important point to understand at step two in the planing process is that all plans are compared

to the same baseline piles of good and bad things without a plan implemented. The decision cannot be a good one unless the without condition description is fair and accurate. The piles have to include all the important things and those must be measured reasonably.

The No Action Alternative

The without project condition describes what society will have to forego if action is taken. Conversely, that means the without project condition is what will result if no action is taken. When formulating plans, NEPA regulations require that the no action alternative always be considered. In essence, this requires any action that is taken to be more in the public interest than doing nothing. The without project condition is, then, the default recommendation, the no action alternative.

It has been suggested by experienced planners and plan reviewers alike that one of the most common problems with Corps planning efforts is that the without condition description is not adequate. In the worst instances, the most likely future condition description can be slanted to favor a specific alternative plan. It would not take much to manipulate the descriptions of the things that go into our good and bad piles in a manner that could distort results. Sometimes the descriptions are naive or incomplete. A good without condition description is essential to a good decision.

CHARACTERISTICS OF A GOOD WITHOUT PROJECT CONDITION

Table 24 summarizes some characteristics of a good without project condition. First, it is **comprehensive**. *The without condition must adequately describe the future.* Significant variables, elements, trends, systems and processes must be sufficiently described to support good decision-making. If it's important to the decision process, it has to be addressed in the without project condition description. Planners cannot overlook important information.

Table 24: Characteristics of a Good Without Condition

1. Comprehensive
2. Rational
3. Alternative Future Oriented
4. Honest
5. Inclusive

Next, the without condition must be **rational**. Forecasts must be based on appropriate methods and professional standards must be applied to the use of those methods. *Accuracy is an important element of a rational scenario.*

Good without conditions are not irrational. All future scenarios should be based on the assumption of rational behavior by future decision-makers. Future scenarios must make sense. Scenarios that rely on an unlikely series of events or irrational behavior make no sense. If a problem can be solved by a \$500,000 expenditure each year or a one time \$1,000,000 expenditure it would be irrational

to assume an indefinite expenditure of \$500,000 under most circumstances. A good scenario must pass the test of making common sense.

Policy May Affect Without Condition

Without project conditions should be rational. Rationality can come from different directions, however. Section 4-11 of ER 1105-2-100 provides a list of eight constraints to and clarifications of the without project condition.

Suppose for example, Congress has established a clear Federal interest in undertaking certain activities through legislation, as it has done with flood control. Further suppose that if the partnership does not build a project the non-Federal partner will. What is the without project condition? The truth is the without project condition includes the project! In this case, however, paragraph 4-11.a.(8) says:

If local interest (sic) are willing to build a given flood control project, but only if the Corps doesn't do it, assume no project as without project condition.

Without project conditions are not before and after comparisons. Before and after comparisons can miss the causality that is important to effective plan evaluation. For example, suppose a county had 2,000 jobs before a wetland restoration project and 10,000 jobs after the project. Can we say the addition of 8,000 jobs is attributable to the wetlands restoration? No, we can't.

Suppose our look at the most likely future without this project included legalized gambling that would have resulted in 11,000 total jobs because it would have included an additional casino at the water's edge where the wetlands would be restored. Then we'd see a with and without comparison would indicate that the wetlands restoration actually cost society 1,000 jobs.

Without project conditions have to be future oriented. Conditions that concentrate on causality of existing conditions and focus too narrowly on how existing conditions might change fail

to be future oriented. They also need to be oriented toward comparing alternative future scenarios. This, in essence, precludes a naive before and after impact comparison.

The fourth characteristic of a good without condition is **honesty**. *This obviously means there should never be deliberately misleading information in a scenario, nor should any important information ever be deliberately withheld.* This quality goes beyond basic honesty, however, to include the forthrightness about the strengths and weaknesses of the analysis that is needed to enable an interested stakeholder or a decision-maker to make their own qualitative assessment of the work you have done.

An honest scenario would point out weaknesses and soft spots in the analysis, taking care to try to identify the implications of these "faults". Honesty also implies a sincere effort in conveying the full implications of the scenario. Honesty requires that if significant differences in the future scenario exist they are also honestly and completely described as alternate without project conditions.

A good without project condition is also **inclusive** in the sense that is subjected to rigorous review and comment as part of the public participation process and throughout the coordination and review process. *Because the without project condition occupies such a critical role in the planning process, it is essential that it be developed in the open and subjected to the scrutiny of all project stakeholders before the project proceeds too far.*

In some cases this will simply mean that technical data and information receive an unbiased thorough technical review. In other cases, where judgmental or technological changes are being considered, the review and coordination may be a structured part of the public participation process.

Planning studies are solving problems of interest to real people;

TELLING A GOOD STORY

Story telling is an art form that apparently has been almost entirely overlooked by the authors of many Federal documents. *Planning studies are solving problems of interest to real people; that makes an important and interesting story, if it is told well.* Good stories always have a beginning, a middle and an ending. They leave out nothing that is important and they include nothing that is irrelevant.

Describing the without project condition need not be a dry litany of resource conditions now and in the future. Explain what you're doing and why it is important. Some simple descriptive text that paints a picture of the future while relying on appendices for detail and data could be an effective way of telling an important story.

SUMMARY AND LOOK FORWARD

Lesson One. Planning studies are iterative processes. The problems and opportunities of the planning area cannot be understood until we have information about existing and future conditions. The distinctions between the first and second steps are not as clear as we would like them to seem.

Lesson Two. Planners need information not data; but data contain the necessary information. In a world of limited budgets, the key is to collect the data needed, not the data available. An information gathering strategy can help you identify what is needed and where to get it.

Lesson Three. Acknowledge the uncertainty you face. No one expects you to forecast perfectly. Let stakeholders and decision-makers know the limits of your knowledge and certainty.

Lesson Four. Describe the without condition as comprehensively, rationally, honestly and inclusively as you can. Use more than one scenario if necessary.

Now that we know the problems and opportunities and have described future conditions without a plan, we need some plans that can alter that future in a favorable way. Formulating alternative plans is the subject of the next chapter.

CHAPTER EIGHT: STEP THREE - FORMULATING ALTERNATIVE PLANS

*"Think left and think right and think low and think high. Oh, the thinks you can think up if only you try." FROM DR. SEUSS IN **Oh the Thinks You Can Think.***

STEP THREE: "Formulation of alternative plans." (P&G STANDARDS, SECTION III PARAGRAPH 1.3.2 (A)(3))

INTRODUCTION

Put on your thinking caps, this is the step where you're going to need them. Your training might take you this far, but nothing prepares you for plan formulation. Where do plans come from? People devise plans. They do it individually and in teams, using an uneven mix of experience, analysis, inspiration, intuition and inventiveness. Over time, the usefulness of old ideas may be reenforced if they have any usefulness at all. To think that way is particularly important in non-traditional planning efforts where new problems and new perspectives on old problems require new ideas and new plans.

The most important elements in plan formulation are creativity and inventiveness. These require planners to break out of old, self-perpetuating patterns of thinking and generate new ways to look at things. **Lateral thinking** needs to supplement **vertical thinking**. Both are needed to succeed in formulation.

Vertical thinking follows the most obvious and probable line of reasoning. It's based on mechanistic information processing principles such as are used in mathematics and logic. Like climbing a stair, it proceeds one step at a time in a predictable direction. Lateral thinking, on the other hand, tries to get away from patterns that lead in one definite direction. Lateral thinking seeks to break out of one's habitual domain of thought. It is based on biological-based information processing.

Typically, all thoughts, all information gathering and interpretation, and all search at some point in the planning process begin to pull in one direction. The problem solving gets "locked in" through a process that builds logically on all the prior steps taken. This is not undesirable. A logical process that zeros in on a solution is clearly valuable, if the solution is a good one.

Sometimes, however, solutions require a sideways move in another direction. Does flood damage reduction need more and higher levees? That's vertical thinking. Or, do evacuation and flow easements make more sense? That's Lateral thinking. Lateral thinking is not necessarily better thinking, but it is

necessary to assure that we make informed decisions. *A good plan, "the best plan," can only be selected if the array of alternative plans provides a good set of feasible alternatives. There is no way to get a good plan from a weak set of alternatives. Great plans come only through purposely challenging and extending one's habitual ways of thinking.*

SOME BASIC CONCEPTS

Figure 10 illustrates the general relationship among strategies, measures and plans. Strategies are the most general, measures the most specific. Plans are the bridge between measures and strategies. These terms are introduced with a simple example adapted from Zeleny.

Suppose our general objective is to travel from Washington, D.C. to New York City for a meeting. There are many strategies we could employ: walking, car, bicycle, motorcycle, regularly scheduled airlines, trains, buses, helicopters, limousines, etc. At this point, there is no way to evaluate any of these strategies because we don't know our constraints or our specific objectives. Are there time or money constraints? Would side trips be desirable? How about safety en route?

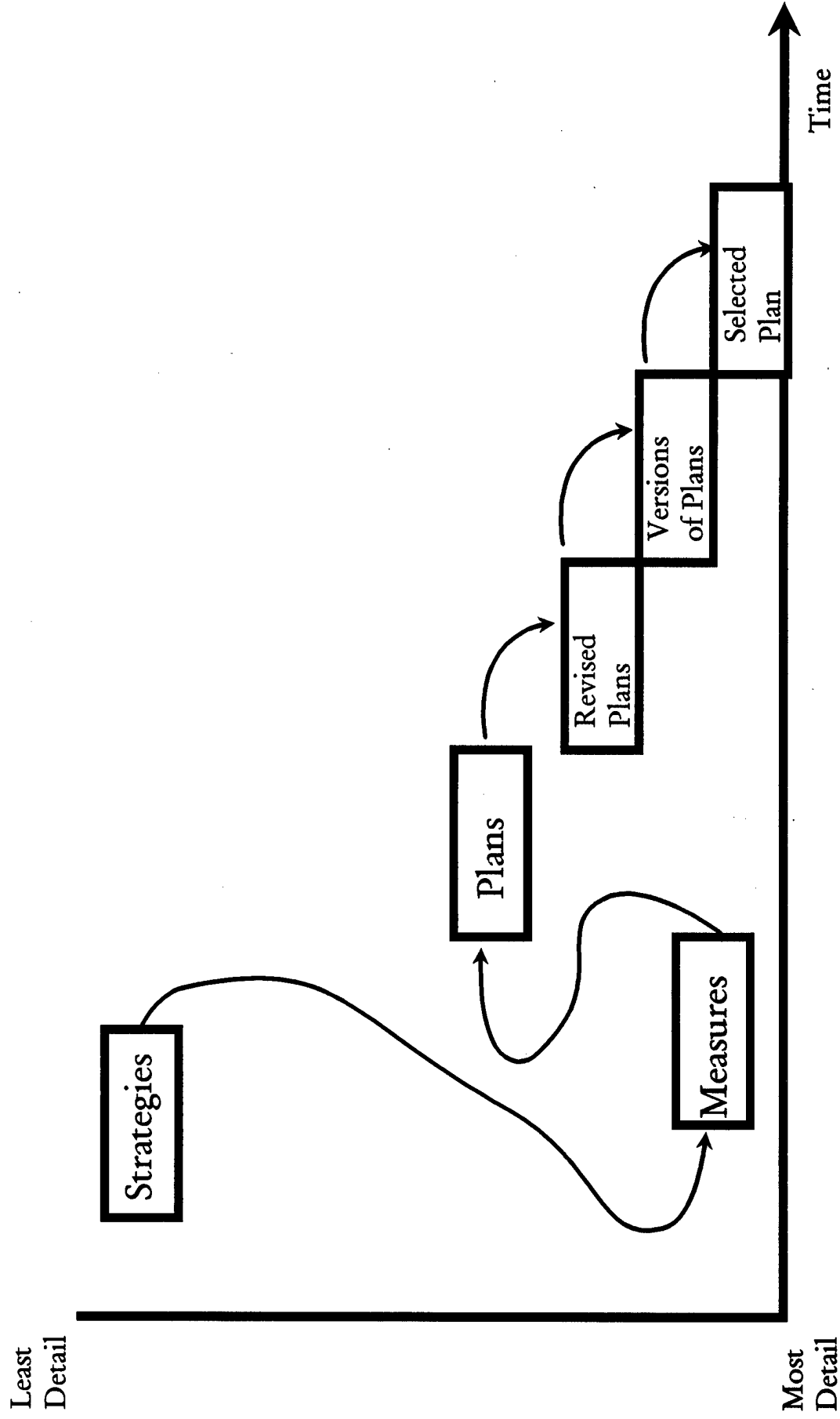
Suppose we want to complete the travel in under four hours. Not all the strategies are options for solving our problem any more. Air travel seems the best strategy. The specific measures that could help us achieve this goal would be leaving from Baltimore-Washington International Airport, Dulles International Airport, or National Airport; the many airlines at each airport and their schedules, taxis to and from the airport, subways or trains to and from the airport, rides from friends, etc. We can begin to assemble these measures into alternative plans for traveling from D.C. to New York in less than four hours. A sample plan could be to take the airport shuttle from the Dixie Hotel at noon to BWI for the 12:45 Kato Air Flight to Kennedy Airport from which you take a taxi to downtown. The alternatives are mutually exclusive activities from among which a choice is possible.

The above example uses vertical thinking. Applying a little lateral thinking to this problem we might ask a few questions. Why do we want to go from D.C. to New York? Might a phone call do? Would a teleconference be even better? If personal contact is essential perhaps you could meet the people from New York half way, in Philadelphia. Renting a helicopter or a plane might get you to New York faster than regularly scheduled airlines.

Strategy, as used here, has a contextual meaning. It is an amorphous conceptual approach to solving a broadly defined problem or achieving a broadly defined opportunity. It's principle characteristic is that it remains general, almost philosophic, in approach.

Strategies may be results-based or means-based. *Results-based strategies define your approach to a problem in terms of the results you seek, regardless of the*

Figure 10: Strategies, Measures and Plans



means. Means-based strategies define your approach in terms of the means you'll use regardless of the results. Thus, we can consider ecosystem restoration results, e.g., increased biodiversity or we can consider means of providing ecosystem restoration, e.g., regulation of salinity levels or wetlands creation.

A **measure** is defined in Webster's Unabridged Dictionary as a: "Means to an end; an act, step or proceeding designed for the accomplishment of an objective." Our working definition of a measure is that it is a means to resolve a problem or realize an opportunity as expressed in the planning objectives.

Measures are the specific actions that can be taken to address one or more of the planning objectives. Measures are the building blocks of which plans are made. They are specific structural components or nonstructural actions that can be used to meet a planning objective. Measures become more specific when planning areas and objectives are well defined.

It may be helpful to think of measures as one of two types: features or activities. **Features** are defined loosely as structural elements, i.e., things that have to be assembled or constructed. Examples for environmental restoration include fences, food plots, brush piles, nest boxes, roosting platforms, channel modifications, water control structures, water pumps, and artificial potholes. **Activities** are also loosely defined as nonstructural actions that may be periodic or ongoing. Examples include seeding, clear cutting, trimming, burning, hunting restrictions, grazing agreements, and water quality regulations. It's less important to be able to put a measure in the proper box than it is to know that there are different kinds of measures.

A **plan**, according to Webster, is a "scheme for making or doing something." Our working definition for a plan is that it is one or more compatible measures that make significant feasible contributions to one or more planning objectives. Plans are also called **alternatives**. A **program** is a collection of plans.

Strategies, alternatives, and measures represent different levels in the decision process. Strategies are introduced at the most general level. Measures come in at the most specific and detailed level. Plans are considered in the ultimate decision process. The time axis of Figure 10 indicates the typical sequence of considering strategies, plans and measures.

Planning Language

Solution: A solution is a way to achieve, in whole or in part, one or more planning objectives. Solution is an umbrella term for three more familiar terms: management measure, alternative plan, and program.

Management Measure: A management measure is a feature, an activity, or some combination of the two, implemented at a specific geographic site.

Feature: A feature is generally a structural element, requiring site construction.

Activity: An activity is generally a nonstructural, ongoing (continuing or periodic) action.

Site: A site is a land or water location.

Alternative Plan: An alternative plan is one or more management measures.

Program: A program is one or more alternative plans, usually located over a large geographic area.

We begin with strategies when we are in need of general directions in which to proceed. From the general we leap frog to the consideration of specifics. Specific measures are worthless, however, until they are given meaning by being combined in light of a specific set of planning objectives. This is a step that requires the combination of trivially specific measures into solutions to more general problems.

WHAT IS A PLAN?

"An alternative plan consists of a system of structural and/or nonstructural measures, strategies, or programs formulated to alleviate specific problems or take advantage of specific opportunities associated with water and related land resources in the planning area." (P&G p. 6)

*Plans should
result in
actions.*

Plans are specific proposals designed to meet stated study-specific planning objectives. After they're formulated, they're evaluated and compared to determine which one is best. The specific proposals are combinations of one or more measures.

Plans should result in actions. Those actions need not include construction. Changes in the management of resources, institutions, and human behavior can be more effective than structural projects in some instances. Thus, a plan need not be a physical project.

A strategy is too general to be a plan. A measure is too narrow. Plans usually consist of several measures. A single measure can become a plan if it contributes significantly to the achievement of the planning objectives and it cannot be combined with another measure to increase that contribution. Plans are differentiated from one another by virtue of the different measures of which they are composed. There can be many versions of the same plan. Distinct versions of a plan are differentiated based on the plan's dimensions. Though these different versions of the same plan are sometimes called alternative plans, they are not. They are refinements of a single plan and are more properly called **versions** than alternatives.

Alternative plans must have different combinations of measures. They are different designed approaches to meeting planning objectives. A plan might have a concrete channel as its single measure. If the final array of plans comprises concrete channels with 25-year, 100-year and standard project flood (SPF) capacities they are not three alternative plans. They are three versions of a single plan.

PLAN DIMENSIONS

How can we distinguish alternative plans from different versions of the same plan? *Alternatives consist of different measures or measures combined in significantly different ways*¹³. *The measures themselves are multi-dimensional.* They can vary in their precise **physical location (site)**, their **size (scale, amount)**, their **construction material (composition)**, and their **timing (duration, staged implementation)**.

Suppose we have identified a range of alternative plans to address a flood damage problem. For simplicity of exposition assume each plan comprises a single measure. Plan A is a floodwall, B is a levee, C is a channel, D is a reservoir, and E is permanent evacuation of the flood plain. Suppose the evaluation and comparison steps of the planning process have eliminated all but the floodwall choice, Plan A. The next formulation task is to determine the proper dimensions of the floodwall. That is, the optimal siting, scale, composition, and staging of construction are yet to be determined.

A concrete or steel sheetpile wall does not constitute two different plans. They are two versions of the same plan. Likewise, 100-year vs. SPF protection are not separate plans. They are different scales of a plan. A wall in front of or behind the railroad is another example of a distinction based on one of a single plan's dimensions rather than an example of alternative plans. Questions about whether to build the plan all at once or to phase the construction in over time are also dimensional issues.

The final array of plans presented in many planning studies is not really an array of alternative plans at all. These arrays are often variations of a single plan. There is nothing wrong with making the final selection from among a set of **refinements** of a single plan as long as this final array resulted from a more comprehensive formulation process. The formulation process must pass through the various stages necessary to develop a good, comprehensive set of alternatives. This means that at some point a wide array of truly different plans was considered.

PLAN FORMULATION DEFINED

Plan formulation is the design of alternative plans that will meet planning objectives. The interdisciplinary team that is formulating a water resource project defines the combination of project measures that comprise a plan in sufficient detail that realistic evaluation, appraisal and comparison of the plan's contributions to the planning objectives as well as its costs to society can be identified, quantified and

¹³ For example, suppose we have a town with two creeks. Plan A will channelize one creek and build a levee along the other. Channel B builds the levee along the first creek and channelize the second. Both plans consist of the same measures but the specific use of these measures is sufficiently different as to comprise two separate plans.

considered. This design draws on the teams' scientific training, experience with similar projects and problems, imagination and judgment. The specific plan design is tempered by the study's constraints.

Plans must be formulated to address the planning objectives. The more formal formulation of alternative plans, as described in this chapter, cannot begin until the planning objectives have been at least preliminarily identified. Formulation of plans implies purpose and that purpose only finds definition in the planning objectives. Generally, a reasonable amount of information must be available before alternative plans can be formulated as it is part of the formulation process to eliminate clearly infeasible plans from further consideration.

In most cases, there will be more than one possible layout of project measures that will meet the planning objectives to varying extents. A good planning team will eliminate the least suitable alternatives while refining the remaining alternatives fairly and comprehensively.

Frequently there is a temptation for the formulation of a project to emphasize structural details, costs, project outputs/services, safety, reliability and other engineering matters. Formulation must also pay attention to the environmental, sociological, institutional and other factors or unimplementable plans will be developed.

Where Do Plans Come From?

One-hundred and thirty Corps professional were recently asked this question, their response. . .

Most people identified non-Corps interests as a source of alternative plans. The "local sponsor" was, by far, the most popular response.

Many people identified the study team and authorities within the Corps as sources of alternative plans.

Some people identified technical expertise, creative thinking, experience, analysis, and politics as sources of alternative plans.

FORMULATION AS AN ITERATIVE PROCESS

The plan formulation process begins where you are. Sometimes you find yourself at ground zero with no prior information. In other studies you may have an earlier Corps study that has done a significant amount of the formulation already. Some studies begin with a plan from another agency or a plan preferred by the non-Federal partner. *Plan formulation is not a monolithic process that always begins at the same place using the same processes.*

The general progression of the formulation process in a study that does not begin with any preconceived notions of alternative plans moves through three

stages from the general to very specific designs of plans¹⁴. *First, planners consider alternative strategies.* Strategies are distinguished here by their lack of detail and specific form. Flood damage reduction, wetland protection, emergency augmentation of water supplies, etc. would be examples of strategies. The first iteration of plan formulation will be at this general and vague level of alternatives.

In the second stage of the formulation process plans are designed in terms of specific types of measures. This is a significant step away from the vagueness of the first cut at plan formulation. *In the third stage the different dimensions of the alternatives become more specific.*

If we were to give names to these three stages we'd call the first stage "thinking about plans"; the second stage would be "formulating alternative plans"; and, the third stage would be "refining plans". Thinking, formulating and refining are three different stages that move from the general to the specific to the detailed specific.

The process is really quite simple. First, you think about how to approach a problem. Then you turn to what will solve it. When you've determined the how and the what, the final question is how much? Plans are developed in this second stage and refined in the third.

ALTERNATIVE PLANS AND THE P&G

GENERAL

The P&G establish the current rules of the game for plan formulation and warrant some explicit consideration. In this section selected topics from Section VI of the Standards are discussed.

First, plans are composed of measures that can be **structural** or **nonstructural** (Section VI.1.6.1(a)). Alternative plans are to be **significantly differentiated** from one another (Section VI.1.6.1(b)). This is the basis for the distinctions we make between alternative plans and refinements of plans.

The P&G provide planners with significant leeway for developing plans. Plans need not be restricted to things the Corps has the authority to do. Planners are empowered by the P&G to develop plans that can be implemented by other Federal agencies, state and local government or other organizations (Section VI.1.6.1(c)).

¹⁴ The stages we speak of here are not formal stages in a formal process. They are simply an organizational framework to facilitate the discussion of how plans evolve from general to specific designs.

Despite this leeway, the Corps is limited in what they can implement by the priorities of any given

...the opportunity to innovate is there.

Administration. Nonetheless, the opportunity to innovate is there. The realm of the Corps' activities is not expanded by great leaps forward as much as by marginal extensions of existing and new authorities. Some districts do plan beyond what they have existing authority to implement. Under the proper circumstances they are sometimes permitted to venture into a new area. It is important to note that the P&G do not make existing authority to implement a plan a requirement for formulating plans that solve problems and capitalize on opportunities.

Mitigation in the general sense means to diminish or alleviate the effects of something unpleasant or harmful. In water resources planning applications the more common effects mitigated include: adverse effects on fish and wildlife habitat; adverse effects on cultural resources; relocation of residential and commercial activities; and, induced flood damages. Appropriate mitigation of effects on fish and wildlife habitat is explicitly required (see, P&G Section VI.1.6.1(g)).

No matter whether we call mitigation an objective or a constraint and regardless of the type of mitigation required, one or more planning objectives should address the need to mitigate a plan's effects. Then, if an alternative plan incorporates a combination of measures that address the complete set of planning objectives mitigation will be incorporated in the design of a plan as it should be, before formal plan evaluation begins. In no case should mitigation measures be added onto a plan after evaluation. The practice of identifying an NED plan and then adding mitigation measures to it is incorrect.

THE NED PLAN AND FORMULATION

The P&G require the formulation of an NED Plan defined as follows:

"A plan that reasonably maximizes net national economic development benefits, consistent with the Federal objective, is to be formulated. This plan is to be identified as the national economic development plan." (P&G, Section VI.1.6.3)

This does not mean planners formulate an NED plan per se. *They formulate an array of plans that meet the planning objectives and constraints and contribute to the planning goal of NED. From this array they are required to identify the NED plan.* Done well, this means planners will identify both an NED plan and additional plans that contribute to the NED goal. The clear intent is that planners investigate enough plans that meet the planning objectives and constraints to assure that they have identified the plan that maximizes net NED benefits.

OTHER ALTERNATIVE PLANS

The P&G clearly permit other plans to be formulated; alternative plans "may" (Section VI.1.6.2(a)) but "should" (Section VI.1.6.4(a)) be formulated. The decision-maker will then judge whether the contributions to planning objectives are sufficient to offset the foregone net NED benefits of a plan is other than the NED plan. *The locally preferred plan is the name frequently given to a plan that is preferred by the non-Federal partner over the NED plan.* It is a commonly designated alternative to the NED plan.

...plans may be single-purpose or multi-purpose.

The number of alternative plans depends on the extent of problems and opportunities in the study area, study resources, the availability of different appropriate measures and the preferences of the stakeholders (Section VI.1.6.4(b)). If there are overriding and compelling reasons for favoring a plan other than the NED plan, that rationale must be presented. Plans less costly than the NED plan are more likely to be exempted from the requirement to select the NED plan than one more costly plan (ER 1105-2-100 paragraph 5-16).

MULTI-PURPOSE PLANNING

Water resource plans may be **single-purpose** or **multi-purpose**. *The purpose of a plan may be thought of as its primary output.* Traditional purposes of Corps projects include flood damage reduction, navigation, hydroelectric power, municipal and industrial water supply, agricultural water supply, recreation, hurricane and storm damage protection, aquatic plant control, water quality improvement, fish and wildlife mitigation and enhancement. A single-purpose plan serves one of these purposes a multi-purpose project serves two or more of these purposes.

During the 1960s the age of the multi-purpose reservoir peaked. Plans were formulated to achieve significant levels of several outputs. Since that time multi-purpose projects have tended to be primarily for one purpose with some ancillary inclusion of other purposes. *There is nothing in the P&G that precludes multi-purpose planning.*

The P&G are but one expression of national policy and priorities. The budget of the United States includes another important expression of national priorities. Each Administration sets its own budgetary priorities. *In recent years budget guidance issued to the Corps has identified those outputs or purposes that can be considered priority outputs.* Only these will ordinarily be considered for inclusion among the budgetary priorities of the Nation. Recently, these priority outputs have been restricted to flood damage reduction, navigation and environmental restoration.

Planners are faced with a dilemma. On the one hand they are admonished to develop plans that fully address a community's problems and needs¹⁵ while Administration policy tells them such plans may not be considered a high priority. When walking through such political ground planners must tread with sensitivity. The sum total of the current situation is that planners are limited in what they can do but there is some flexibility. *Comprehensive multi-purpose planning is not currently practical but some multi-purpose planning is possible.* Perhaps the best practice is for planners to be positive and capitalize on what policy and circumstance permit.

MULTI-OBJECTIVE PLANNING

Multi-objective planning is a confusing term because different organizations have different objectives, as discussed in Chapter Six. At a national level, multi-objective planning is no longer done. The P&G officially commit the Nation's water resource agencies to a single Federal objective, national economic development, subject to certain environmental constraints. As pointed out in the history presented in Chapter Three there have been times when planning was multi-objective at the Federal level. Most recently before the P&G replaced the Principles and Standards, there were two co-equal Federal objectives, NED and EQ. At other times NED, RED, EQ, and OSE have been defacto Federal objectives.

When most people talk about multi-objective planning they generally are referring to the past practice of more than one Federal objective. While water resources planning and policy have evolved over time the ultimate purpose of such plans and programs has always been to meet human wants and needs. These wants and needs are more complex than national economic development and include many other study-specific objectives as well.

Although Federal policy is currently single objective in nature, remember that this single objective is a goal for the Federal/non-Federal partnership and the planning team. Recall that the wants and needs of the partnership can result in the identification of many planning objectives. Some of these planning objectives will address environmental problems or opportunities, others may address economic or social concerns. *Hence, plans formulated to meet a variety of planning objectives can be called multi-objective in nature.* Within any given study, the evaluation and comparison of the different plans' contributions to these many objectives can apply different weights to the trade-offs among the objectives. Thus, it is possible for a planning study to be effectively multi-objective in approach although the official Federal policy is single objective planning.

¹⁵ Congressional authorizations and the P&G provide this charge.

GENERATING ALTERNATIVES

WHERE DO PLANS COME FROM?

People generate plans. Planners are the most obvious source of plans, but they are not the only one. The non-Federal partner may identify a plan. Plans may come from any of the stakeholders in the planning study. Plans may come from previous studies or the broader literature. They can come from non-Corps experts. The following paragraphs consider some generic methods for generating plans.

In another sense, however, plans come from the planning objectives and constraints. *Plans emerge from a well developed set of objectives and constraints over time as the planning team completes its iterations of the planning steps.*

General Approaches to Plan Formulation

There are some tried and true methods for generating plans. They include. . .

- Ask an expert - Use professional judgment and informed personal intuition.
- Plans of others - Measures, plans and programs may also be developed by others and provided to the planning team.
- Models - Clues to applicable measures may be found in models. For example, habitat models may provide clues to the types of measures that result in restoration gains.
- All combinations - Assemble all possible combinations of management measures and systematically eliminate from the list.

METHODS FOR DEVELOPING PLANS

In a series of workshops and training courses held around the country during 1995, Corps planners were asked, where do plans come from? There are three recurring and overlapping themes that emerge from a great variety of answers. *Plans come from: i) sources outside the Corps (particularly the local sponsor; ii) study team and other Corps authorities; and iii) other sources such as technical expertise, experience, and creative thinking.* Each involves people. The diversity and expertise of the interdisciplinary team is essential for developing solutions to complex and wicked problems. The public, i.e., all stakeholders who are not principles in the partnership, must be provided an active and inclusive role in all aspects of the planning process, including the formulation of alternative plans.

In this section we address the "how" of plan formulation rather than the "who" of plan formulation. Let us begin with the one truth we have been able to uncover about the how of formulation, there is no one way to do it. The corollary to this truth is there is no sure way to do it either but the most effective ways begin with and use the planning objectives throughout the process.

In one form or another the literature and experienced planners alike acknowledge two factors in plan formulation: experience and inventiveness, as noted in the survey above. The **heuristic search method** discussed below is one of the most common methods used to exploit the experience factor. Some methods

that facilitate creativity are mentioned as are a few more sophisticated methods of developing alternatives. This section closes with the description of a simple method of linking measures and, subsequently, plans to the planning objectives.

THE HEURISTIC SEARCH METHOD¹⁶

Heuristic search may be the most common aid to designing solutions to problems in use today. Heuristic search relies on the use of simple rules of thumb, such as: "call up your old professor and ask her for some thoughts"; "go down the hall and ask Pat, he knows more about this than anyone"; "have a one hour meeting of planning division and brainstorm ideas"; or, "find a bulletin board or newsgroup on the Internet and see what you can find out."

...ask Pat, he knows more about this than anyone...

Making the heuristic search more systematic would immediately improve the process. Purposeful and deliberate information discovery and retrieval from a variety of sources is still relatively neglected. When planners seek to exploit the experience of others, how often do they call another district? Experts in academia? Retired personnel? Other outside experts?

In-house personnel are frequently not fully exploited. Systematic searches of data banks are rarely undertaken. The systematic search for potential solutions as opposed to, say, the information sought in step two of the planning process merges the search for alternatives with their design. Introducing systematic formulation methods into the planning process may offer the single greatest potential for enhancing the range and quality of alternatives. *If people come up with plans and people have experience, then a systematic effort to involve as many people as possible can only help.*

Do not misunderstand the intent, however. A broader and more innovative array of alternatives can be obtained by using published materials like professional planning journals, textbooks, previous and related reports, and the information superhighway in all of its manifestations. The judicious use of the telephone can turn up new ideas or sources for new ideas. Call someone in academia who knows the literature. Call other Corps employees and start asking around. Making your heuristic search more systematic may be the cheapest and best way to improve your array of plans.

¹⁶ A more detailed description of this method may be found in the following references: D. G. Marquis, "The Anatomy of Successful Innovations," *Innovation*, 1 (1969):28-37. W.F. Pounds, "The Process of Problem Finding," *Industrial Management Review*, 11 (1969): 1-19. H.A. Simon, *Models of Discovery* (Dordrecht-Holland: D. Reidel, 1977).

PLAN DESIGN METHODS

There are a number of methods that have been developed to assist organizations that need to plan or solve problems. They go well beyond the heuristic search methods that are most common. Some of these are quite well developed and can serve as formulation methodologies. Even their brief description is well beyond the scope of this manual. In instances where a structured and systematic approach for formulating plans to meet planning objectives is desired, one or more of these techniques may be worth investigating. Some of these techniques include analysis of interrelated decision areas (AIDA)¹⁷, the morphological box,¹⁸ the IDEALS concept,¹⁹ idealized design,²⁰ issue-based information systems (IBIS),²¹ strategic choice approach,²² and strategic options development and analysis (SODA),²³.

Good ideas are things that work.

Some of these methods have been developed in the context of problem solving, but in every case they involve the design, what we call formulation, of alternative means of problem solving. All of these methods help to develop decision options of one type or another. The interested planner is directed to the referenced material for additional details.

GOOD IDEAS

Good ideas are things that work. In the case of formulation, they're measures that contribute to the attainment of planning objectives. There are many tried and true planning measures that are good ideas. The value of levees and floodwalls has been proven time and again. Experience and analysis will frequently

¹⁷ Luckman, J. (1967) "An Approach to the Management of Design" *Operational Research Quarterly* 18:345-58.
Morgan, J.R. (1971) "AIDA-A Technique for the Management of Design" IOR Monograph No. 2. London: Tavistock Institute of Human Relations.

¹⁸ Zwicky, F. *Discovery, Invention, Research Through the Morphological Approach* (New York: MacMillan, 1969).

¹⁹ Nadler, G. *Work Systems Design: The IDEALS Concept* (Homewood, IL: R.D. Irwin, 1967).

²⁰ Ackoff, R.L. *The Art of Problem Solving* (New York: Wiley Interscience, 1978).

²¹ Dehlinger, H. and J.P. Protzen, "Some Considerations for the Design of Issue Based Information Systems (IBIS)," *DMG-DRS Journal: Design Research and Methods*, 6(2)(April-June 1972):38-45.

²² Friend, J.K. and W.N. Jessop (1977) *Local Government and Strategic Choice: An Operational Research Approach to the Processes of Public Planning* (Second Edition). Oxford: Pergamon. [First Edition (1969)-London: Tavistock Publications].

²³ Eden, Colin (1989) "Using Cognitive Mapping for Strategic Options development and Analysis (SODA)" in *Rational Analysis for a Problematic World: Problem Structuring Methods for Complexity, Uncertainty and Conflict*, Jonathan Rosehead, ed. New York: John Wiley & Sons.

be enough to identify these kinds of good ideas. But, where do new good ideas come from? That is a far more vexing problem.

We don't know where good ideas come from. However, new plans might be generated in a number of ways:

1. By inventing or introducing new overall strategies for approaching a type of problem.
2. By inventing or introducing new measures to address specific planning objectives.
3. By developing new combinations of old measures.
4. By creating or introducing new planning objectives.
5. By creating or introducing new evaluation criteria.
6. By modifying existing strategies and measures to meet new objectives.

A Whack on the Side of the Head

A Whack on the Side of the Head, How You Can be More Creative by Roger von Oech, is one of many popular self-help books geared toward helping people become more creative in their thinking. Van Oech asks, "Why don't we 'think something different' more often?" His answer is: first, that we don't need to for most of what we do; second, we haven't been taught to; and, third, our belief systems or attitudes prevent us from doing so. In his book, the author identifies ten attitudes or mental locks that keep us from thinking more creatively. The mental locks are reproduced here, some suggestions for unlocking them are found in his book.

- | | |
|-----------------------|-----------------------|
| 1. The Right Answer | 6. That's Not My Area |
| 2. That's Not Logical | 7. Avoid Ambiguity |
| 3. Follow the Rules | 8. Don't Be Foolish |
| 4. Be Practical | 9. To Err is Wrong |
| 5. Play is Frivolous | 10. I'm Not Creative |

While these ideas lend some structure to the attempt to exploit people's inventiveness and creativity, by themselves they are of limited value. These are strategies for developing new measures and alternatives. What we need are some methods for generating new ideas, i.e., creative problem solving techniques.

CREATIVE PROBLEM SOLVING TECHNIQUES

If ready-made solutions are not likely to solve a problem and you're looking for some structured approaches to creative thinking **creative problem solving techniques** (CPS) could help. These techniques are essentially idea generating techniques used to formulate solutions to problems. Table 25 lists 46 such techniques.

Some are designed for use by individuals others by groups. Individuals looking for ways to break out of their habitual ways of looking at problems might try some of these approaches to aid their own creativity. If the acceptance of solutions by others is critical then group methods can be used to aid lateral thinking and the development of good ideas. Team efforts to generate alternatives may be well served by some of these techniques.

Table 25: Idea Generation Techniques

- | | |
|--|---|
| <ul style="list-style-type: none"> • Individual Techniques <ul style="list-style-type: none"> - Analogies - Progressive Abstractions - Metaphors - Hypothetical Situations - Reversals - Wishful Thinking - Attribute Listing - Catalog - Checklists - Focused-Object - Free Association - Fresh Eye - Listing - Nonlogical Stimuli - Relational Algorithms - Circumrelation - Lateral Thinking - Morphological Analysis - Idea Tracking - Packays Scientific Approach • Group Techniques <ul style="list-style-type: none"> - Battelle-Bildmappen-Brainwriting - Brainwriting Pool - Classical Brainstorming | <ul style="list-style-type: none"> • Group Techniques (Continued) <ul style="list-style-type: none"> - Collective Notebook - Crawford Slip Writing - Force-Fit Game - Gallery Method - Gordon/Little - Method 6-3-5 - Phillips 66 - Pin-Cards - Semantic Intuition - Successive Integration of Problems
Elements Method - Stimulus Analysis - Synectics - Systematized Directed Induction - Trigger Method - Visual Synectics - Wildest Idea - Bobele-Buchanan - Coca-Cola - Creative Problem Solving - Delphi - Nominal Group Technique - Phase of Integrated Problem Solving - Problem-Centered Leadership |
|--|---|

Source: Van Gundy's *Techniques of Structured Problem Solving*, p. 29.

The methods vary in complexity. Some can be used immediately, others will require training. Although it is not practical to review these methods in this manual, interested planners can find a discussion of each technique, as well as additional references, in Arthur B. VanGundy's 1981 book, *Techniques of Structured Problem Solving*.

OBJECTIVES-MEASURES MATRIX

Plans are made up of one or more compatible and feasible measures that contribute significantly to the set of planning objectives. *Thus, a reasonable starting point for plan formulation is an examination of the relationship between planning objectives and plan measures.* A simple preliminary formulation exercise would be to identify and list as many measures as possible, but at least one, for each planning objective. This will give substantial emphasis to each planning objective. If there is diversity in the specification of planning objectives and industry and creativity in the identification of measures, this approach should ultimately produce a truly differentiated array of alternative plans.

This initial approach can be considered simply the creation of an objectives-measures matrix. Table 26 presents a four-step process for creating a planning objectives-planning measures matrix that can be used as a formulation tool. An **objectives-measures matrix** is just one example of a way planners might approach the problem of assembling plans. An objectives-measures matrix can be prepared at each formulation cycle; through the planning process as objectives are refined, better information about the measures becomes available and plan evaluation and comparison proceeds.

Table 26: Objectives-Measures Matrix in Four Steps

1. Begin with your planning objectives (Step 1)
2. Identify as many measures to address each objective as possible, at least one for each objective
3. Determine which measures can be combined.
4. Screen combinations of measures.

The first step is to identify the planning objectives. If that was done in the first step of the planning process, the objectives can be considered given. Suppose, for the moment, there were three planning objectives identified at this stage of the

Efficiency and Effectiveness

There are two common optimization problems planners face. One is minimizing costs subject to an output constraint, the other is maximizing output subject to a cost constraint. Although economists insist efficiency covers both these situations, planners sometimes make a distinction between the two.

A plan that produces a given level of output is efficient if it is impossible to produce that level of output at a lower cost. This assures that we do not waste resources. Waste is inefficient. This is the former optimization problem. Thus, a plan that produces \$1 million in flood damage reduction benefits at a cost of \$0.5 million is more efficient than a plan that produces those benefits at a cost of \$0.7 million.

That plan is effective if it produces the greatest level of output possible for a given cost. This eliminates the possibility of doing more with your resources. This is the latter optimization problem. Thus, if we have a \$1 million plan that produces \$1.3 million in flood damage reduction benefits and a \$1 million plan that produces \$1.5 million in benefits, the second plan is more effective.

Neither efficiency nor effectiveness address the issue of equity. Equity is a fairness issue that arises from how the benefits of a project are distributed among the general population.

study's progress. The second step is to identify measures that address each planning objective directly or indirectly as shown in Table 27. This is the most critical step in the entire plan formulation process, it is the "A #1" activity in the third step of the six-step planning process. As many measures as possible should be identified. This is the time to "think the thinks you can think." More creativity is required in identifying the measures than in the actual assembly of those measures into plans.

As a general rule, as many measures as possible should be identified for each objective. At least one measure must be identified for each objective, however. We cannot be sure we have the best plan unless we have the best set of alternatives from which to choose. Choice requires more than one option. Though multiple measures will not always be possible for each objective, it remains a modest goal. Under no circumstances should there ever be an objective that is not addressed by at least one measure. An objective that has no measures that contribute to it is unattainable and is either not an objective at all or the formulation process has been inadequate.

Figure 11 presents a sample matrix summarizing the first two steps of this formulation method. The objectives and measures have been arrayed as columns

Table 27: Objectives and Measures

Objective 1:	Reduce flood damages in those communities currently protected by the Federal flood control system
Measure 1:	Levees in protected area
Measure 2:	Floodwalls in protected area
Measure 3:	Bridge modifications in protected area
Measure 4:	Reservoirs
Measure 5:	River diversion
Measure 6:	Dredge river
Measure 7:	Island removal
Measure 8:	Channel modifications
Measure 9:	Flood forecast and warning
Measure 10:	Evacuation of floodplain and protected area
Measure 11:	Flood-proofing and nonstructural in protected area
Measure 12:	Flood insurance
Objective 2:	Minimize induced flood damages and flooding in communities upstream and downstream of the study area
Measure 4:	Reservoirs
Measure 5:	River diversion
Measure 6:	Dredge river
Measure 7:	Island removal
Measure 8:	Channel modifications
Measure 9:	Flood forecast and warning
Measure 12:	Flood insurance
Measure 13:	Levees in induced flooding area
Measure 14:	Floodwalls in induced flooding area.
Measure 15:	Evacuation of floodplain in induced flooding area
Measure 16:	Flood-proofing and nonstructural in induced flooding area
Objective 3:	Maintain or increase the quantity and/or quality of fish and wildlife habitat in protected area
Measure 4:	Reservoirs
Measure 10:	Evacuation of floodplain in protected area
Measure 17:	Creation of bird islands
Measure 18:	Mitigate acid mine drainage into Big River
Measure 19:	Construct fish channels on Big River tributaries
Measure 20:	Construct duck boxes
Measure 21:	Construct watering holes
Measure 22:	Wetlands restoration

Figure 11: Objectives-Measures Matrix**DRAFT**

Measure	Objective 1	Objective 2	Objective 3
1: Levees protected area	X		
2: Floodwalls protected area	X		
3: Bridge modifications protected area	X	X	
4: Reservoirs	X	X	X
5: River diversion	X	X	
6: Dredge river	X	X	
7: Island removal	X	X	
8: Channel modification	X	X	
9: Flood forecast and warning	X	X	
10: Evacuation protected area	X	X	X
11: Flood proofing & nonstructural protected area	X	X	
12: Flood insurance	X	X	
13: Levees induced area		X	
14: Floodwalls induced area		X	
15: Evacuation induced area		X	X
16: Flood proofing & nonstructural induced area		X	
17: Bird islands			X
18: Mitigate acid mine drainage			X
19: Fish channels on tributaries			X
20: Duck boxes			X
21: Watering holes			X
22: Wetlands restoration			X

and rows to create a 3 by 22 matrix. The rows show the objectives to which a particular measure contributes. In the example, reservoirs and floodplain evacuation contribute to each of the three objectives. They show the various measures that contribute to a specific objective. Next, we need to know which measures can be combined into potential plans.

...the "all combinations" approach to plan formulation.

The third task is to determine which measures can be combined. There are at least two schools of thought on how to do this. *One school relies on the "all combinations" approach to plan formulation. In this approach, planners identify all measures that can conceptually be combined.* These combinations are then screened to eliminate inefficient and ineffective combinations.

The all combinations method can be tedious. With 22 measures there are hundreds of possible pairs of measures and that does not include combinations of more than two measures. Clearly, scoping to determine what combinations are important and screening to determine which are worthy of further consideration are needed in this process.

It will generally be possible to make certain study-specific judgments about the compatibility of measures, as has been done for our hypothetical example in Figure 12. Measures that can be combined with other measures are indicated by a "YES," incompatible measures are indicated by a "NO". The matrix reflects only pair-wise combinations and does not indicate what measures might be incompatible in combinations of more than two measures. In the example, levees in the protected area are considered potentially compatible with measures 3, 7, 9, and 12 through 22. It has been determined that levees aren't compatible with measures 2, 4, 5, 6, 8, 10, or 11. The matrix of Figure 12 summarizes a first cut of potential plans from the all combinations method but it leaves a dizzying array of potential plans.

Under the all combinations approach to plan formulation we would take every logical combination of two or more measures that can be assembled by combining the YES's of a row. Thus, one plan relying on levees would include measures 1, 3, 7, 9, and 12 through 22. Another would be measures 1 and 3, or 1 and 7, and so on. The all combinations method begins by considering any combination of the 22 measures and proceeds to eliminate them in increasingly sophisticated rounds of screening. Clearly this list has to be narrowed.

This can be done in any number of ways. We could look at measures that support the third objective and identify combinations that don't work, consequently eliminating another group of potential combinations. For example, if we determine that fish channels and watering holes would not be used together, no plan would include measures 16 and 21 together. Next, we could begin to look at measures that become incompatible in combinations of three or more. As this elimination process continues we begin to zero in on a final array of plans that have

[illegible]

A second approach ...builds an array of plans from scratch.

withstood a logical assault on their construction. Elimination would begin at the intuitive gut-feeling level and proceed through the sophisticated screening of the final iterations of the planning steps.

A second approach to plan formulation is a constructive one, in the sense that it builds an array of plans from scratch.

Instead of putting all possible combinations in the ring and eliminating them, first in groups then individually, we could begin with an empty ring and build plans from combinations of the measures. In this approach, plans have to meet preliminary screening criteria in order to be considered. As the number of contenders grows we eventually begin to eliminate plans through the formal evaluation, comparison and selection process.

At some point in the formulation process, as the number of possible plans becomes more manageable or as the number of contending plans gets large enough, it may be helpful to subjectively group the potential plans into categories from best to worst. Using screening criteria and the evaluation and comparison of plan effects, plans are eliminated. The best plans would be clearly carried forward for further consideration and refinement.

CHARACTERISTICS OF GOOD PLANS

Good plans emerge from a rational iterative planning process that has considered a comprehensive set of alternative plans. Good plans make significant contributions to the overall set of planning objectives and do not violate planning constraints. At some point in the planning process they are sufficiently differentiated from one another as to offer a full range of truly different alternative approaches to achieving the planning objectives. Different versions of a plan are developed based on optimizing the dimensions of the plan consistent with the planning objectives and the criteria for alternative plans. Good plans are more complete, more effective, more efficient and more acceptable than bad plans. Good plans solve problems and take advantage of opportunities. Good plans remain multi-objective in practice while they emphasize the NED objective in traditional planning settings. Good plans pursue multiple purposes when they make the most sense. Good plans are not constrained for lack of authority. Good plans are difficult to formulate.

SUMMARY AND LOOK FORWARD

Lesson One. A plan is one or more compatible measures that make significant feasible contributions to the set of planning objectives.

Lesson Two. The P&G require the identification of an NED plan from among the alternatives considered and this is expected to be the selected plan unless there is a strong rationale for deviating from it.

Lesson Three. A good plan can only emerge from a good set of truly differentiated alternative plans and optimized versions of these plans.

Lesson Four. Multi-purpose and multi-objective planning still makes a lot of sense when formulating alternative plans.

Lesson Five. There are many methodologies available to assist the formulation process, from idea generation to screening alternatives.

The most rational way to move from an array of many plans toward identification of one best plan is by evaluating the effects of the different plans. Evaluation is the fourth step in the Corps' planning process and it is the subject of the next chapter.

CHAPTER NINE: STEP FOUR - EVALUATION OF ALTERNATIVE PLANS

"WE CANNOT DISCUSS THE EVALUATION OF THINGS WITHOUT KNOWING WHAT IT IS THAT IS BEING EVALUATED." FRANK H. KNIGHT (1885-1972), *Risk, UNCERTAINTY AND PROFIT*, 1926, p. 125.

**STEP FOUR: EVALUATION OF THE EFFECTS OF THE ALTERNATIVE PLANS.
(P&G SECTION III.1.3.2(A)(4))**

INTRODUCTION

The purpose of evaluation is to find the value or worth of something. Only the best of the alternatives formulated need to be evaluated in more than a preliminary fashion, but all strategies, measures and plans require some evaluation. Evaluation is an essential part of the screening process. Plans that have successfully survived the screening process must be more formally evaluated. *Evaluation is a two-part process: assessment and appraisal.* It, like all other planning steps, is also an iterative process. Evaluation begins with the first screening activities. The detail and rigor of the evaluation process increases as planning moves closer to a decision.

Assessment is the quantification of plan effects and it is based on a comparison of most likely future conditions in the study area without and with a plan in place. Each plan, including the no action alternative is individually assessed.

Appraisal is the process of assigning significance and value to the effects measured in the assessment process. Monetized project effects like benefits and costs are essentially weighted and valued by their dollar magnitudes. Thus, appraisal of non-monetized plan effects such as those found in the EQ, RED, and OSE accounts is more demanding. Appraisal, like assessment, is not a comparison of plans, it is the consideration of a single plan.

The appraisal essentially judges the effects identified and measured in the assessment process. It is in the appraisal that we gain a sense of what effects are good, which are bad, and how good or how bad they are when judged against societal standards. Subsequently, in step five of the planning process, the relative goods and bads of plans are compared and differences are traded-off.

...as we begin to identify alternatives we start eliminating them.

This chapter begins by revisiting the notion of the screening process introduced in Chapter Five. It then proceeds to a more detailed consideration of

what is meant by assessment and appraisal. It concludes with the consideration of some evaluation methods in use by the Corps of Engineers.

SCREENING ALTERNATIVES

As soon as we begin to identify alternatives we start eliminating them. This is part of the screening process called **screening alternatives**, as opposed to

screening measures or strategies. Screening is accomplished by iterating steps four, five and six. In the early formulation iterations, the evaluation, comparison and selection steps may be compressed, even to the point of being instantaneous judgments at times. Planners can't possibly consider all the alternatives that are conceptually possible and for good reason. Most of what is conceivable is not feasible.

Figure 13 illustrates the notion of how screening is used to reduce a potentially large number of alternatives to a manageable number. Of all the conceivable plans, some will not be environmentally feasible, others will not be economically feasible and so on. For example, we might confidently disregard reversal of flow alternatives for the environmental and economic havoc they would reap without ever evaluating those plans formally. We can eliminate relocation of the town because it would lack social and political support. We may be able to eliminate many other options based on engineering judgment or potentially high costs. Though the evaluation may not be formal in every iteration of the steps, evaluation is, nonetheless, an important part of the screening process.

SCREENING CRITERIA

If planners must eliminate alternatives without very formal or sophisticated evaluations, how can that be done? *The P&G (Paragraph 1.6.2(c)) suggest the use of four criteria, completeness, effectiveness, efficiency and acceptability, in the formulation of alternative plans. Use of these criteria in screening alternative plans early in the*

Evaluation of Effects

The P&G defines evaluation in paragraph 1.3.6 of Section III of the Standards as follows:

(a) *General.* The evaluation of the effects of each alternative plan consists of assessment and appraisal.

(b) *Assessment.* Assessment is the process of measuring or estimating the effects of an alternative plan. Assessment determines the difference between without-plan and with-plan conditions for each of the categories of effects.

(c) *Appraisal.*

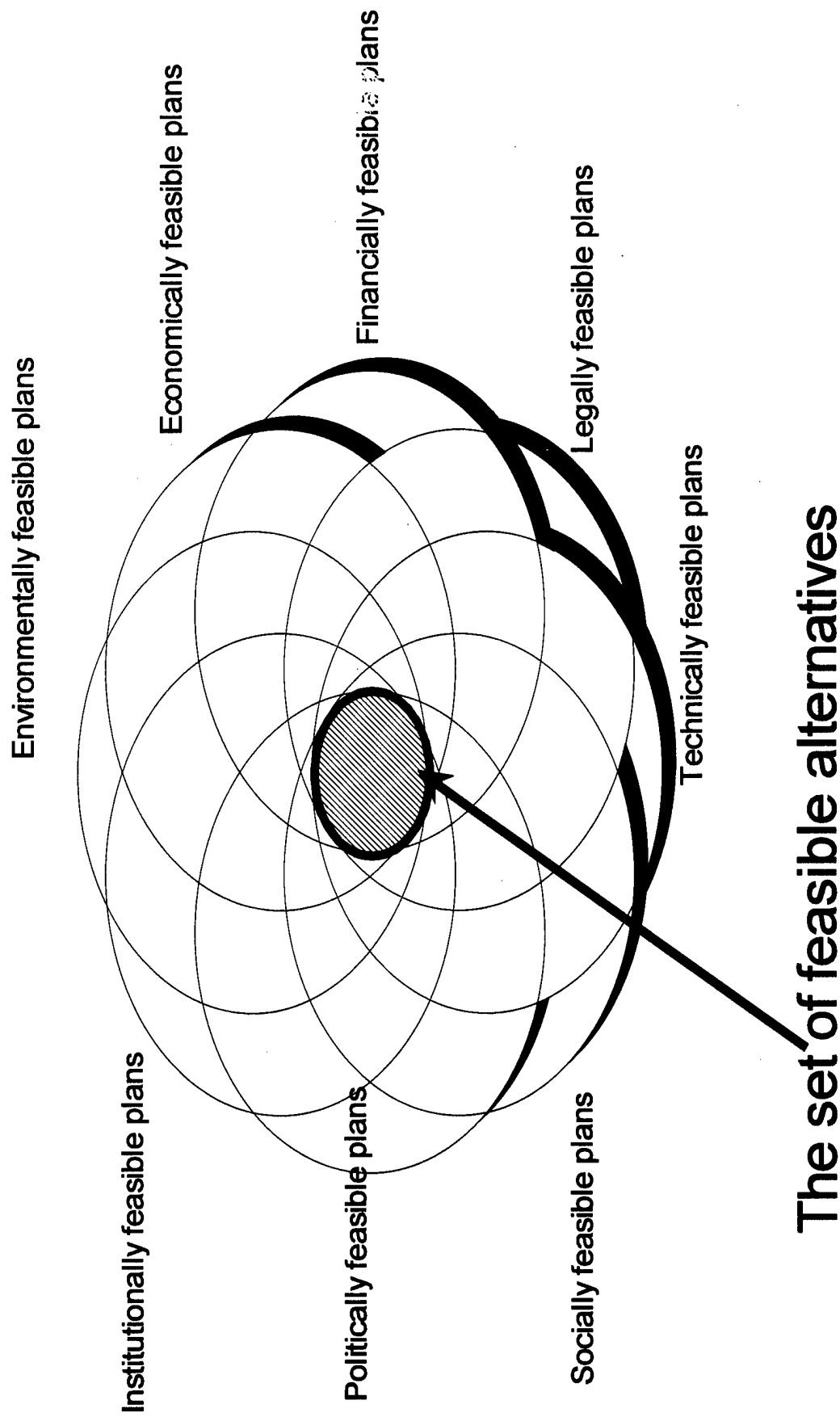
(1) Appraisal is the process of assigning social values to the technical information gathered as part of the assessment process.

(2) Since the technical data concerning benefits and costs in the NED account are expressed in monetary units, the NED account already contains a weighting of the effects; therefore, appraisal is applicable only to the EQ, RED, and OSE evaluations.

(d) *Displays.* The results of the evaluation should be displayed according to the directions provided in Section VII-Displays.

Additional description can be found in paragraphs 3.4.9 through 3.4.14 of Chapter III-Environmental Quality (EQ) Procedures.

Figure 13: Screening Plans



planning process requires that they remain qualitative in application. Plans are formulated to meet these criteria and they are evaluated against these criteria to measure their success in doing so. These same criteria are generally applied against the final array of plans as well, once the evaluation and appraisal of plans is complete.

A complete alternative is...well thought out.

These criteria are subjective, not objective. There is no objective measure of completeness. They are not pass/fail criteria, they are more or less criteria; as in Plan A is more complete than Plan B, but it is less efficient. In fact, these criteria may be best used by placing the plans being screened or evaluated on a continuum for each criterion as shown in Figure 14. In the figure, plan A is more complete and more acceptable, but it's also less effective and efficient than plan B. Plans are more or less complete, effective, efficient, and acceptable than one another and when no one plan dominates all others, trade-offs must eventually be made in the screening process. However, in the evaluation step it is sufficient to place the individual plans on a continuum. That doing so may implicitly or even explicitly require some comparison simply highlights the fact that the planning process is not one of nice discrete steps.

COMPLETENESS

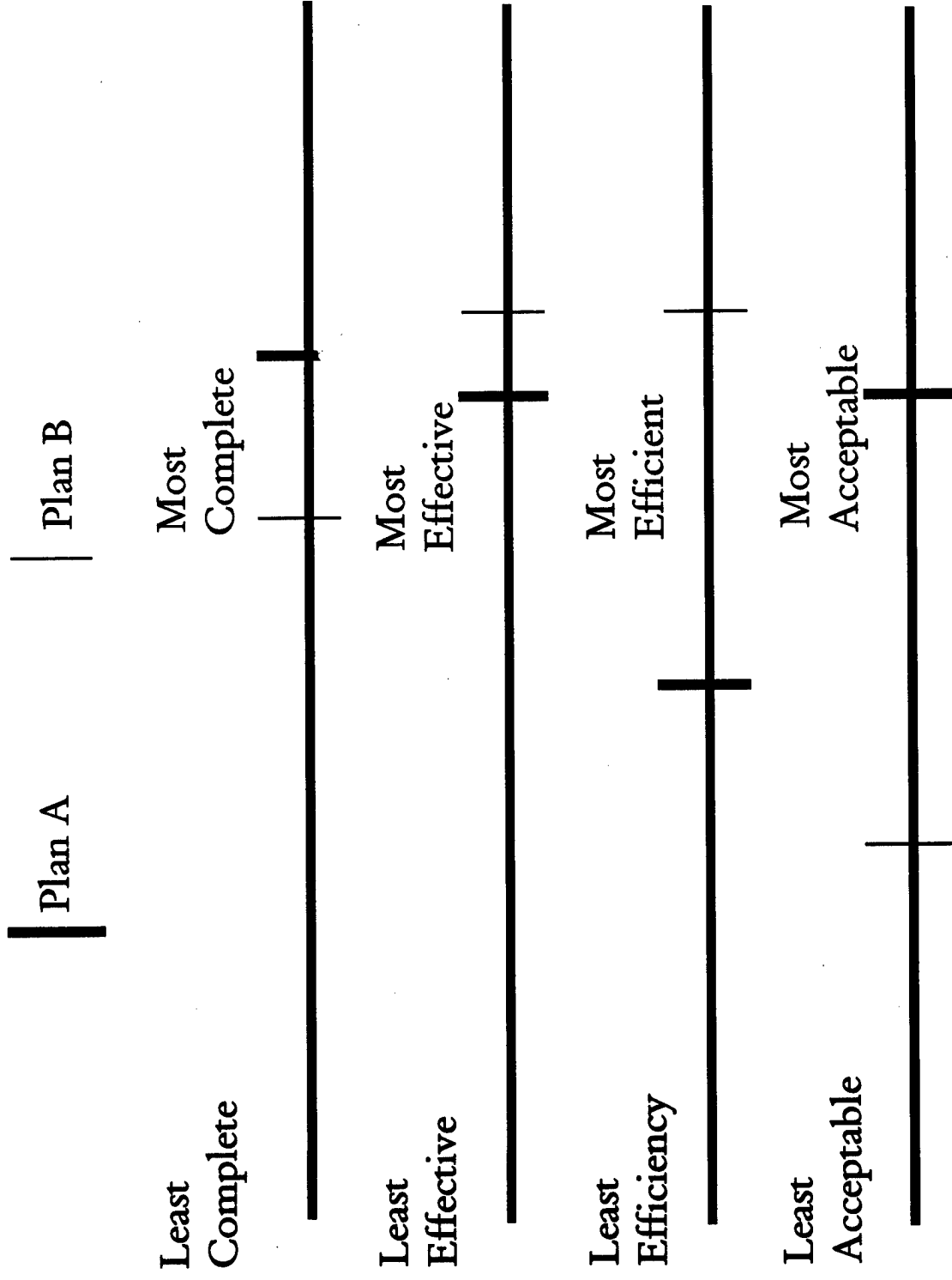
"Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. This may require relating the plan to other types of public or private plans if the other plans are crucial to realization of the contributions to the objective." (P&G Section VI.1.6.2(c)(1))

A complete alternative is one that is well thought out. All the necessary implementation actions have been accounted for in the planning process. During the screening process plans are not likely to be complete and this criterion will be of limited use for screening.

Following evaluation and appraisal of alternative plans, when plan effects have been identified it is important to scrutinize the plan to assure that it includes all that is necessary to realize the plan effects. For example, a plan that relies on a strong economy or world petroleum markets to produce all of the navigation benefits forecast is not as complete as a plan whose benefits do not depend on factors beyond the control of the planners.

To establish the completeness of the plan it is helpful to list those factors beyond the control of the planners that are required to make the plan effects a reality. If a plan's effects, like project benefits, will not be realized unless there is a strong international economy, dredging of private berths, and relatively peaceful conditions in the oil-producing nations, these factors must be identified. The plan is not complete unless these conditions are met.

Figure 14: Screening and Evaluation Criteria



EFFECTIVENESS

“Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities.”
(P&G Section VI.1.6.2(c)(2))

An effective plan is responsive to the wants and needs of people. An effective plan makes a significant contribution to the solution of some problems and achieving some opportunities. In other words, it contributes to the attainment of the planning objectives.

The most effective alternatives make significant contributions to all the planning objectives. “Effectiveness”, then, becomes an imprecise matter of degree. How much does an alternative contribute to how many planning objectives? The answer determines how effective an alternative is.

In the screening process it is often possible to identify alternatives that make no contribution to the planning objectives or that make obviously insignificant contributions when compared to other alternatives. When this is the case, these alternatives can be rejected because they are relatively ineffective. When the formal evaluation process has been completed the extent of a plan's effectiveness may well be quantified, facilitating a more objective application of this criterion.

EFFICIENCY

“Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment.” (P&G Section VI.1.6.2(c)(3))

When you think about cost-effectiveness don't think only about dollar costs. Costs refer not just to the number of dollars that will have to be paid to implement a plan but to opportunities that will be sacrificed if the plan is implemented.

Efficiency refers to the allocation of resources. Are resources used efficiently in the construction of a project or the implementation of a plan? Are the outputs produced by the plan produced in an efficient manner? Are the resources that are going to be significantly affected by the plan still going to be available for efficient use by society?

The more familiar articulation of the criterion of efficiency is **cost-effectiveness**. Of all the ways of developing and implementing a plan, have we identified the most cost-effective means of implementation? An obvious question is, is there a cheaper way to accomplish the same objectives? If there is, we do not have a cost-effective plan.

The efficiency criterion transcends the NED criterion, however. When all tangible/monetary and intangible/non-monetary costs are considered do we have the least costly plan? If a plan costs society the loss of some wetlands and there is another way to achieve the same objectives with no or less wetland loss, then the plan is not efficient.

Efficiency must be considered in light of all opportunity costs, not just monetary costs. This makes the efficiency criterion considerably more difficult for planning for the Corps' environmental mission because planners may have to trade-off increased implementation costs against less environmental losses.

In the screening stage of the formulation process there will be no explicit cost information and alternatives will be rejected when the orders of magnitude of costs are different for similar levels of outputs. In the formal evaluation stage of planning direct comparisons of costs will be possible for many alternatives.

ACCEPTABILITY

"Acceptability is the workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public policies." (P&G Section VI.1.6.2(c)(4))

If a plan has opposition...that doesn't make it unacceptable.

*There are two primary dimensions to acceptability. One we call **implementability**, meaning is it feasible in the technical, environmental, economic, social, etc. senses. The other is the **satisfaction** it brings. A common error that must be avoided with this criterion is the tendency to equate acceptability with the non-Federal partner's willingness to sign a Project Cooperation Agreement for the plan, if they would sign it is acceptable, if they wouldn't it is not. This is not what acceptability means. If it were, there would be no need for a partnership or a planning process at all. The locals need only say, this is what we want.*

To be acceptable to state and local entities as well as the public a plan has to be capable of being done. There are many factors that can render a plan infeasible. These factors can generally be categorized as technical (engineering or natural world limitations), economic, financial, environmental, social, political, legal, and institutional. Figure 13 illustrated this notion of feasibility.

If a plan cannot be done for legitimate reasons, it is not feasible. If a plan has opposition or is not the favored plan of the non-Federal partner that does not make it infeasible or unacceptable. That simply makes it unpopular. If a plan requires changes in laws or authorities that doesn't make it unacceptable. That only makes it difficult.

Acceptability can also be defined as the extent to which a plan is welcome or satisfactory. These are qualitative dimensions, not absolutes. If a plan is feasible

The Championship Bout

The planning process is not easy for new planners to grasp. Sometimes analogies can be helpful. Here's an unlikely one that describes how the last three steps of the planning process, evaluation, comparison and selection, fit together. Think of planning in terms of the hype before a championship boxing match. In the evaluation stage of the bout the boxers appear at the weigh-in. Here they are assessed. They are weighed, their height is verified, their reach documented, their fists measured, etc. Then they are appraised by the fans. Looking at the measurement results they conclude the champ is paunchy and overweight, the challenger has been working hard, and so on.

After they're evaluated, the fighters are compared. The champ is ten pounds heavier but the challenger has a two-inch reach advantage. Both are the same height. One is quicker, the other more powerful. People begin to favor one fighter over another. In the selection stage of the prize fight, after the boxers have been evaluated and compared, people make their selections and put their money on the one they think will win. Evaluation, then, is the weigh-in of the planning process.

in a pragmatic sense in that it could be done, there is no object way to determine what is welcome or unwelcome, satisfactory or unsatisfactory. *When a plan is feasible, it is more satisfactory than another plan is.* This is not a pass/fail criterion.

In the screening stage, acceptability may be the most useful criterion for eliminating potential alternatives. Certain measures can be eliminated because they are technically unsuitable for certain areas, i.e., they may not meet the site criteria. Distinguishing what is physically possible from what is impossible is not evaluation, it is screening. Using universal standards to identify alternatives as infeasible is appropriate during the screening process in formulation. For example, eliminating a plan that would require disruption of an ancient Indian burial ground in

favor of alternatives that avoid it is screening, not evaluation. Likewise eliminating alternatives that would accomplish the same ends at greater costs can be eliminated at this stage.

In the formal evaluation stage there will be more fully developed and documented rationales for the elimination of alternatives based on feasibility. Though the satisfaction of a plan will remain subjective, sufficient measurement, appraisal and comparison will have been completed to support judgments about which plans and versions of plans are acceptable enough to carry forward for further consideration.

EVALUATION IN THEORY

Screening is used in order to move from a large number of plans to a best plan. An essential piece of this screening is the evaluation process required to go from many plans to one best plan. Evaluation is the process by which planners quantify and weigh a plan's effects. The effects under consideration are defined by the planning objectives and other appropriate criteria for authorization and implementation.

Candidate plans are not eliminated in this part of the screening process, instead the effects of the candidates plans are identified, measured and weighed.

The evaluation process has a dual nature. On the one hand it's part of the screening process and it can be very informal, ranging from an instantaneous judgment based on experience or intuition to a more data intensive analysis. On the other hand, it is a formal and structured process in which effects are appraised, assessed and displayed systematically in a series of accounts. Once a plan passes the screening tests, i.e., it's found to be sufficiently complete, effective, efficient, and acceptable, concepts discussed below, it should be subjected to a more formal evaluation process before it advances to more detailed development or it is dropped from further consideration. Although the evaluation process is iterative and continuous rather than a discrete event in the planning process, all alternatives should be subjected to comparable levels of evaluation rigor and standards.²⁴

The outcome of the evaluation process is that a plan's effects are identified, measured, and weighed. This may be an informal and subjective process, it may involve use of screening criteria or it may be a formal evaluation process. Once plans are evaluated the screening process continues, usually resulting in additional fine tuning of the surviving candidate plans.

Figure 15 illustrates the two parts of the evaluation step. The first step, assessment, is an objective analysis to identify and measure economic, environmental, social, and other effects expected to result from implementation of the plan. The second step, appraisal, is a more subjective analysis that attempts to classify the importance and desirability of plan effects to plan stakeholders.

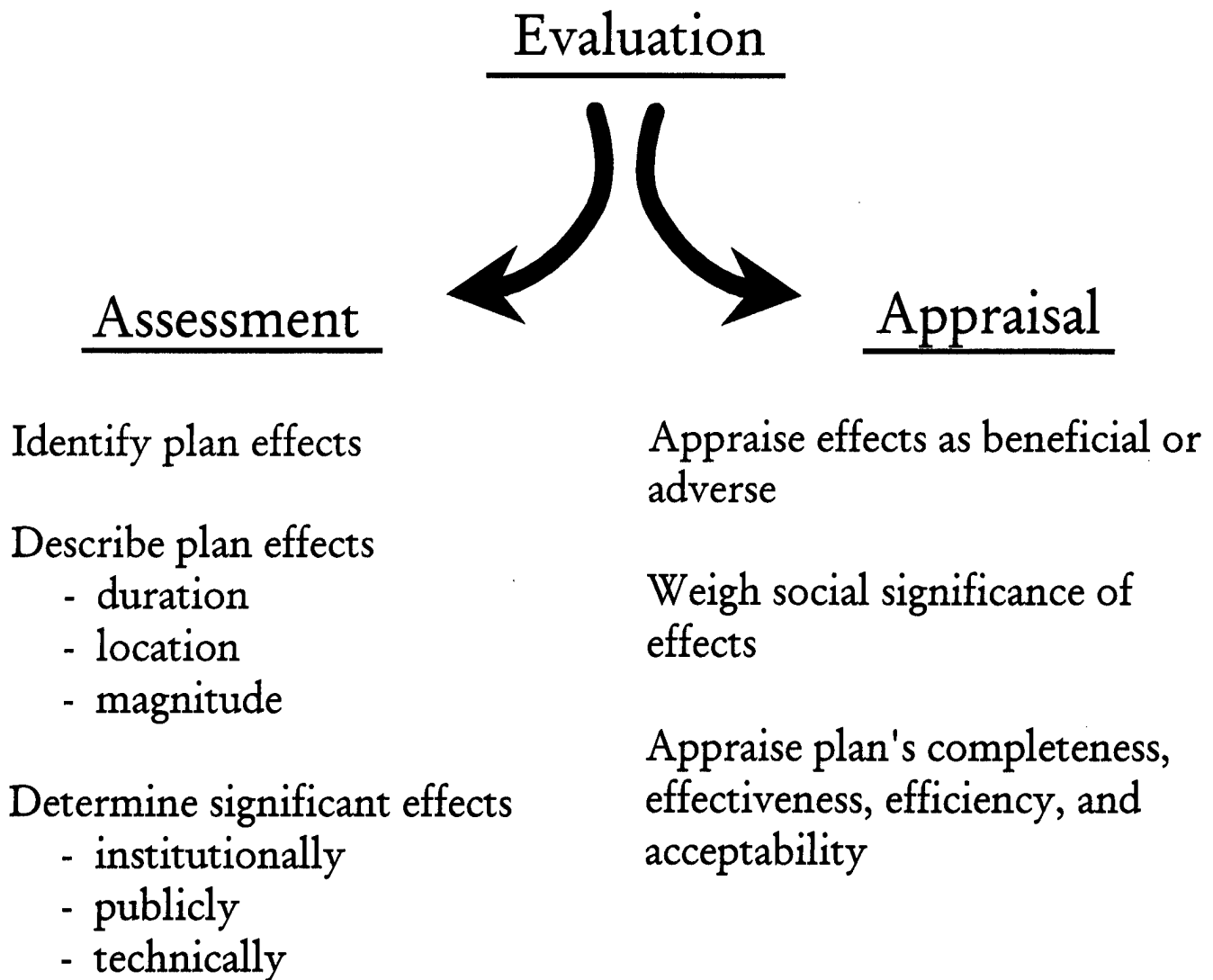
Without and With Project Condition Comparisons

Suppose a study area is expected to have an average of 2,500 acres of tidal wetlands under the without condition. Further suppose that a navigation project would cause the destruction of 1,000 acres of wetlands. Mitigation and enhancement measures included in the plan would create an additional 2,000 acres of tidal wetlands. What is the assessed effect of the plan? How does it contribute to the planning objective of "increasing the total spatial extent of tidal wetlands?"

Using the without and with project condition framework, the plan adds 1,000 acres of tidal wetlands. Under the without project condition there are 2,500 acres. Under the with condition there are $2,500 - 1,000 + 2,000 = 3,500$ acres, a net gain of 1,000 acres. The plan increases total wetlands but it fails to protect acreage in the existing locations.

²⁴ This means all alternatives should receive equal care in the evaluation and screening processes. For example, suppose a new alternative is formulated after several others are well advanced. The new alternative should be subjected to the same screening and evaluation standards the other plans were subjected to when they were first formulated. Plans of comparable quality should be subjected to comparable evaluation standards regardless of the study chronology.

Figure 15: Evaluation



It is important that all significant plan effects be evaluated fully. Final decisions will be judicious only if all the effects of a plan are known. A thorough evaluation will diminish the possibility of a "surprise" after implementation that could be disturbing to the public or stakeholders. Finally, the reputation of the partners rests on their ability to adequately forecast the effects of projects. This latter point can make an assessment of "no change" as important as a measured assessment of change for certain plan effects.

...establish whether an effect is...recognized as important...

ASSESSMENT

Figure 15 indicates three steps in the assessment part of the evaluation process. First, plan effects must be identified. Next these effects should be described. The P&G suggest this description include the duration, location and magnitude of the effect. Third, the significance of the effects must be determined. This third step needs some explanation.

There is a difference between making a value judgment about an effect and determining if it is significant. Determining an effect's significance or importance is a qualification exercise. We need to know if an effect passes some threshold, a minimum level of significance that warrants a more specific appraisal. In the assessment part of evaluation we need to establish whether an effect is institutionally, publicly, or technically recognized as important to people and should therefore be taken into account in the decision-making process.

Institutional recognition of an effect means its importance is recognized and acknowledged in the laws, plans, and policies of government, public agencies and private groups. **Public recognition** means some segment of the general public considers the effect important. Public recognition may be manifest in controversy, support, or opposition expressed in any number of formal or informal ways. **Technical recognition** of an effect is based upon scientific or other technical criteria that establish the significance of an effect. For example, maintaining salinity levels is scientifically established as important to the biodiversity of a freshwater marsh.

In addition to these three steps, three types of information are used in the with and without project conditions comparison to assess effects. *First, you need things to measure.* There must be alternative plans and these plans must have effects that can be identified and described. The long list of potential effects is easy to *identify* if you have done a good job on the planning objectives and constraints. Information will have been collected about natural systems and the human environment during step two and we will be interested in how a plan affects those natural systems and that human environment.

Second, you have to know what is important. There are so many potential effects of a plan that it would be impossible to assess them all. The process of determining what is and isn't important begins in the scoping process described in Chapter Five. Effects that tell you whether and how much you are contributing to the planning objectives will generally also meet the institutional, public or technical criteria of significance discussed above if you've done a good job in establishing planning objectives. An alternative way to approach the determination of significance is presented in Table 28.

Table 28: Significant Effects

1. Determine if it could have any material bearing on decision-making.
2. Consider the scarcity, fragility, and resiliency of the resource.
3. Consider publicly-held views as to the significance of the resources.
4. Determine if the affected resource has been identified as significant by law or in any other way.

An effect is important if it is or could be important to the decision-making process. Any effect that influences the choice of a plan is important. Another indicator of importance is the scarcity, fragility, and resiliency of a resource that will be affected. Effects on scarce and fragile resources can be more important than other effects because they endanger the local viability/availability of the resource. The significance of these resources is often evident in institutional, public or technical recognition of the resource. *Once you have identified an effect as important you need a way to measure it. Measurement means describing the duration, location and magnitude of a plan effect as precisely as possible.* Measurement should be quantitative whenever possible. If an impact can be measured in dollars, habitat units, acres or any other common metric, it should be.

Quantitative measurement is not the only kind of measurement. Effects can be assessed in a subjective manner. Subjective rankings of effects may be possible when quantitative measurements are not. We may not have any metric that quantifies scenic beauty, but it may be entirely possible to say that Plan A contributes more to scenic beauty than Plan C which contributes more than plan B. Without some means of measurement assessment cannot proceed. The general framework for assessing plan effects is the without and with project conditions comparison.

APPRAISAL

The appraisal step in evaluation requires the planner to determine the significance of the measured change. It is a values-based evaluation step in contrast

to the more objective measurement of the assessment step. Effects can't be properly appraised until they have been assessed.

Each assessed effect should be appraised. The first step in the appraisal is to determine if the effect is beneficial or adverse. It will usually be possible to categorize an effect as good or bad. It may be more difficult to say how good or how bad, especially in the earlier iterations of the planning process. The assessment will, however, establish that the level of goodness or badness is important in light of the planning objectives. The loss of wetlands will, for example, always be bad and it will always be important. Noise during construction will always be bad, but is it important? The answers to such questions will have to be given on a case-by-case basis.

Subjective judgments may become easier to deal with once planning proceeds to the comparison step. At that point, phrases like "the same as", "less than", or "more than", can be used to compare a plan to the NED plan or to any other baseline plan. Until then, the appraisal is largely restricted to judgments like "enough", "not enough", "too little", or "too much". The subjective measures tend to be go/no go appraisals that focus on appraising the individual plan. The standards for determine enough, too little, etc. are related to the planning objectives and screening criteria rather than to a comparison of plans. At this step we need to establish whether a plan is good enough to bother comparing it to others.

The next task in the appraisal process is to appraise the plan in light of its overall contributions to the formulation criteria of completeness, effectiveness, efficiency and acceptability. The focal point for doing this should be appraising the specific plan's contributions to the planning objectives. We are seeking some degree of "objective fulfillment". If the plan's effects have been assessed in terms of their relationship and importance to the planning objectives, this will not be too difficult.

With regard to the screening criteria, plans that are not appraised as a "go" for essential planning objectives are not effective. Plans that require substantial activity by others to reach a "go" appraisal for critical objectives are not complete. Plans that achieve contributions to objectives at higher costs, whether objectively or subjectively measured, are not efficient. Plans with effects that result in infeasibility are not acceptable. The four criteria were presented as continuums rather than absolutes. In the evaluation stage of planning, minimum standards for these four criteria must be established in order to determine if a plan is worthy of additional consideration. These standards will generally be subjective.

Formal evaluation comprising assessment and appraisal raises the screening process to new levels of sophistication. Effects are assessed and then they are appraised in a relatively formal framework. The purpose of the evaluation step is to carefully examine each alternative and determine if it is worthy of additional consideration. This is accomplished by holding each plan to a frequently subjective and always study-specific set of minimum standards. These minimum standards in essence represent that required degree of objective fulfillment referred to earlier.

The degree of objective fulfillment may be objective (e.g., reduce flood damages by at least 15%) or it might be subjective (enough/not enough). In either case, the culmination of the evaluation step is a decision whether to continue to consider the plan just evaluated.

WITH PROJECT CONDITION

Chapter Six described the without and with project condition comparison with a simple analogy to the comparisons of two sets of piles of good and bad things. The first task was to determine what was different about the two piles, this is the assessment. The second task was to determine which of the two sets of piles is better. This is essentially the appraisal.

The description of the **existing conditions** in the study area, determined earlier in step two, formed the foundation from which future conditions without a plan were forecast. Though more than one without condition may be forecast, only one will be called the "most likely future condition without a project".

Defining a without project condition required planners to identify key variables, factors, elements and systems that needed to be considered to assure that alternative plans were meeting the planning objectives and to fully evaluate the effects of each plan. In the assessment stage of the evaluation process planners identify important plan effects that must be identified and measured.

In step four the planner must forecast future conditions with the alternative plans in place. A most likely future condition is forecast for each alternative separately. The important variables measured in step two under the without project condition are measured again in step four under the with project condition. The differences in the measured variables are the assessed effects of a plan.

The qualities of a good with condition are similar to those of a good without condition described in Chapter Seven. There may be more than one potential with project condition. When that is possible a most likely condition should be identified but the other conditions should be considered in a sensitivity analysis of the plan's effects.

EVALUATION PROCEDURES

A great deal of guidance already exists for the assessment of plan effects. The P&G contain specific evaluation procedures for estimating NED benefits and costs as well as a set of procedures for evaluating environmental quality effects of a plan. Many of these evaluation procedures have been supplemented by additional guidance. Most notable among this guidance is the series of **National Economic Development Procedures Manuals** prepared by the Institute for Water Resources.

This series of manuals provides additional guidance and examples detailing the evaluation procedures used for NED benefit and cost estimation. These manuals are listed in the references.

ORGANIZING EVALUATION RESULTS

The two part evaluation process described above can result in a great deal of information. That information is of no value unless it helps to improve decision-making. In order to be useful to decision-makers, it must be effectively organized for consideration by team members, stakeholders, the public and partnership decision-makers. The P&G established four accounts to facilitate evaluation and the display of the effects of alternative plans. These accounts have been devised to encompass all significant effects of a plan on the human and natural environments as required by the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.) and Section 122 of the Flood Control Act of 1970 (PL 91-611, 84 Stat. 1823).

THE SYSTEM OF ACCOUNTS

The system of accounts is a way to organize and keep track of the effects of alternative plans. The accounts established by the Principles and Standards and continued by the P&G now include national economic development, regional economic development, environmental quality, and other social effects. The evaluated plan effects are displayed in one of the four accounts. A sample is shown in Table 29.

Strictly speaking, only the NED account is required, though it is common practice to use the four-account system. Though the four accounts provide a convenient and comprehensive method for grouping and summarizing plan effects, there is no requirement to use all of them.

In cases where stakeholders are interested in one particular aspect of a study it may be helpful to create a special account that addresses that concern. If it is convenient to present a wetlands account for a restoration study, or a water use account for a drought study, or town impacts account for a Section 14 streambank erosion study, then by all means do so. Though the four-account system is sufficiently robust to accommodate virtually any plan effect, the P&G permit the use of any system of accounts or alternative display of plan effects as long as NED effects are displayed.

The P&G in Section VII.1.7.1 provide general guidance for displaying plan effects. This includes: a differentiation of short-term and long-term effects; identification of irreversible commitments of resources; consideration of groundwater and instream flows; use of the without and with project condition comparison; monetary quantification of NED effects; appropriate numeric or non-numeric display of EQ, RED and OSE effects; and, expressing all monetary values

Table 29: Summary Comparison of Detailed Plans for Duck Creek, Ohio

	No Action	NED Plan	Locally Preferred Plan
1. PLAN DESCRIPTION	No Action/Without Project Condition	Reach DC-A 25-year protection; & Reach DC-B 600-year protection; & Reach DC-C 100-year protection	Sections DC-A, DC-B, DC-C Uniform 100-year level of protection
2. IMPACT ASSESSMENT			
A. National Economic Development (NED)			
(1) Project Cost	\$0	\$13,895,000	\$14,817,000
(2) Annual Cost	\$0	\$ 1,357,000	\$ 1,445,000
(3) Total Annual Benefits	\$0	\$ 1,721,000	\$ 1,783,000
(4) Annual Net Benefits	\$0	\$ 364,000	\$ 338,000
(5) Benefit to Cost Ratio	N/A Ranks 3rd	1.27 Ranks 1st	1.20 Ranks 2nd
B. Environmental Quality (EQ)			
(1) Air/Noise	Normal noise levels created by traffic, business, and industrial activities. Ranks 1st.	Temporary increased noise levels during 4-year construction period. Ranks 2nd.	Temporary increased noise levels during 4-year construction period. Ranks 3rd.
(2) Water Quality	Existing water quality is poor due to discharges into the stream from combined sewer system outfalls and flood runoff from industrial areas adjacent to the stream. Ranks 3rd.	Temporary increased turbidity levels during 4-year construction period. Contamination from flood runoff from adjacent industrial areas partially eliminated in DC-A, and fully eliminated in DC-B and DC-C. Ranks 2nd.	Temporary increased turbidity levels during 4-year construction period. Contamination from flood runoff from adjacent industrial areas eliminated for all reaches. Ranks 1st.
(3) Vegetation	Existing vegetation typical for streams in Southwest Ohio. Excellent habitat for woodland songbirds and urban wildlife. Ranks 1st.	Permanent loss of 12 acres to project features; temporary loss of 8 acres during 4-year construction period. Ranks 2nd.	Permanent loss of 13 acres to project features; temporary loss of 8 acres during 4-year construction period. Ranks 3rd.
(4) Threatened & Endangered Species	No endangered species in work area.	No impact.	No impact
(5) Aquatic Birds	Existing biological community sparse due to pollutant discharges from combined sewer systems outfalls. Ranks 3rd	Temporary decreased biota populations during 4-year construction period. Possible increase (in biota population with decrease in contaminant runoff from protected industrial areas. Ranks 1st (Tie).	Temporary decreased biota populations during 4-year construction period. Possible increase in biota population with decrease in contaminant runoff from protected industrial areas. Ranks 1st (Tie).
(6) Cultural Resources & Historic Properties	No cultural resources or historic properties in work area.	No impact.	No impact.
C. Regional Economic Development (RED)	Same as National Economic Development (NED) impacts. Ranks 3rd.	Same as National Economic Development (NED) impacts. Ranks 1st	Same as National Economic Development (NED) impacts. Ranks 2nd.

Table 29: Summary Comparison of Detailed Plans for Duck Creek, Ohio

Table 29: Summary Comparison of Detailed Plans for Duck Creek, Ohio				
D. Other Social Effects (OSE)				
(1) Life, Health and Safety	Little or no residential threat. Commercial and industrial property with over 1,000 employees during normal shifts have continued exposure to threat of loss of life, and disruption of health & safety services. Red Bank and Madison Roads flood beginning at 25-year event. Ranks 3rd.	Provides only 25-year level of protection to area DC-A, 500-year to DC-B, and 100-year to DC-C. Red Bank Road flooded by events greater than 25-year. Madison Road will require installation of closures for 10-year floods and higher, with 3 to 4 possible false alarm closures each year. Ranks 2nd.	Provides 100-year level of protection to all damage areas along Duck Creek. Red Bank Road flooding eliminated. Madison Road will require installation of closures for 10-year floods and higher. Other false alarm closures may occur 3 to 4 times a year. Ranks 1st.	
(2) Community Cohesion (displacement of people & businesses)	Future flooding and in particular, occurrence of large flooding events, could displace selected businesses over time. Ranks 3rd.	Some displacement of businesses is possible in low-level protection area DC-A. Displacement of portion of one small business by plan. Ranks 2nd.	100-year level of protection to all homes and businesses in the study area. Displacement of portion of one small business by plan. Ranks 1st.	
(3) Recreation	No existing recreation facilities in the study area floodplain. Ranks 3rd.	Existing low intensity use recreation facility downstream of study area to be used for environmental mitigation site. Compatible with facility master plan. No opportunity or interest by local partners to add other recreation features to proposed plan. Ranks 1st (Tie).	Existing low intensity use recreation facility downstream of study area to be used for environmental mitigation site. Compatible with facility master plan. No opportunity or interest by local partners to add other recreation features to proposed plan. Ranks 1st (Tie).	
3. PLAN EVALUATION				
A. Contribution to Planning Objectives				
(1) Efficiently reduces flood damages to maximum practical extent	Average Annual Flood Damages (AAD) are \$1,844,000. No effective reduction from limited private non-structural measures. Does not meet objective. Ranks 3rd.	Residual AAD = \$174,000 for a 91% reduction in AAD. Meets objective. Ranks 2nd.	Residual AAD = \$113,000 for a 94% reduction in AAD. Meets objective. Ranks 1st.	
(2) Provide optimum level of flood protection	Damage outputs starting at the 2-year flood level. Does not meet objective. Ranks 3rd.	Provides 25-year DC-A, 500-year DC-B, & 100-year DC-C, NED plan. Meets objectives. Ranks 1st.	Provides uniform 100-year flood protection for all reaches. Meets objectives. Ranks 2nd.	
(3) Minimize environmental impacts	Existing vegetation typical for streams in southwest Ohio. Excellent habitat for woodland birds and urban wildlife. Meets objective. Ranks 1st	Permanent loss of 12 acres to project features; temporary loss of 8 acres during 2-year construction period. Temporary disturbed areas to be restored. Enhancement of offsite wildlife areas for mitigation. Contamination from flood runoff from adjacent industrial areas partially eliminated in DC-A, fully eliminated in DC-B and DC-C. Meets objective. Ranks 2nd.	Permanent loss of 13 acres to project features; temporary loss of 8 acres during 4-year construction period. Temporary disturbed areas to be restored. Enhancement of offsite wildlife areas for mitigation. Contamination from flood runoff from adjacent industrial areas eliminated for all reaches. Meets objective. Ranks 3rd.	

Table 29: Summary Comparison of Detailed Plans for Duck Creek, Ohio

B. Response to Planning Constraints				
(1) Financial capability of local partners to cost-share project construction	N/A	Local cost share of \$3,474,000 is within local capabilities. Meets constraint.	Local cost share of \$3,704,000 is within local capabilities. Meets constraint.	
(2) Institutional acceptability	Red Banks and Madison Roads flood beginning at 25-year event flood waters. Ongoing high level of flood damages not acceptable to local partners. Does not meet constraint.	Red Bank Road flooded by events greater than 25-year. Madison Road will require installation of closures for 10-year floods and higher, with 3 to 4 possible false alarm closures each year. Non-uniform level of protection not acceptable to local partners, but acceptable under Federal criteria. Partially meets constraint.	Red Bank Road flooding eliminated. Madison Road will require installation of closures for 10-year floods and higher. Other false alarm closures may occur 3 to 4 times a year. Uniform 100-year level of protection acceptable to local partners and meets Federal criteria. Meets constraint.	
(3) Public acceptability	No acceptable. Does not meet constraint.	Not fully acceptable. Partially meets constraint.	Fully acceptable. Meets constraint.	
C. Response to Evaluation Criteria				
(1) Completeness	Does not meet objective.	Partially meets objective.	Meets objective.	
(2) Effectiveness	Does not meet objective.	Meets objective.	Meets objective.	
(3) Efficiency	Does not meet objective.	Meets objective.	Meets objective.	

in average annual equivalent amounts. The following subsections describe each of the accounts in turn.

National Economic Development

"Contributions to national economic development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct benefits that accrue in the planning area and the rest of the nation. Contributions to NED include increases in the net value of those goods and services that are marketed, and also of those that may not be marketed." (P&G Section II(b))

The NED account is the successor to the historical objective of economic development that has run throughout the history of water resource development in the U.S. The NED account has been described at great length in a series of IWR procedures manuals. Two of these deal with the NED objective in an overview fashion and should be of particular interest to planners. One, the "National Economic Development Procedures Manual - Overview Manual for Conducting National Economic Development Analysis" deals with NED benefits. The other, "National Economic Development Procedures Manual - National Economic Development Costs", deals with the adverse effects of plans on the NED account.

The NED account is the account that includes the estimates of project benefits and costs used to calculate net economic benefits, upon which the economic feasibility of traditional plans rests.

Regional Economic Development

"The RED account registers changes in the distribution of regional economic activity that result from each alternative plan. Two measures of the effects of the plan on regional economies are used in the account: regional income and regional employment." (P&G Section VII.1.7.4(a)(1)).

This account is mentioned second simply because of its close relationship to the NED account. It was once a more formal part of the economic development objective for water resource projects. Not all economic effects, beneficial or adverse, have national implications. For example, a plan may prevent a manufacturer from leaving one area to locate in another. From a national perspective there is no difference. The manufacturer would have been someone in the U.S. producing his wares. From the regional perspective this may be of great importance.

This regional perspective...has become increasingly important to non-Federal partners...

This regional perspective, particularly as it relates to the effects of plans on jobs, income and tax bases, has become increasingly important to non-Federal partners as they have been required to help finance studies and projects. Regional interests want to know more precisely what they are getting for their money. If an NED perspective is intended to protect the national interest in projects, it only stands to reason that as the non-Federal financial stake increases an RED perspective is required to protect the regional and local interests in a project.

There is less Corps' guidance on regional economic analysis but it is the primary type of analysis addressed in the economic literature. There are no shortages of methods, tools or techniques for conducting RED analysis.

Environmental Quality

"Beneficial effects in the EQ account are favorable changes in the ecological, aesthetic, and cultural attributes of natural and cultural resources. Adverse effects in the EQ account are unfavorable changes in the ecological, aesthetic, and cultural attributes of natural and cultural resources." (P&G Section VII.1.7.3(a)(2&3))

Environmental quality is the successor to the preservationist thrust that began earlier in the history of water resource development in the U.S. Consideration of EQ effects, as well as all effects on the quality of human environment, is required by NEPA 1969. Chapter III of the Guidelines is devoted exclusively to procedures for conducting an EQ evaluation. This remains the best source of a detailed description of the EQ assessment and appraisal processes for all planners. ER 1105-2-100 beginning in Section V of Chapter 7 offers additional procedures for environmental evaluation. Sections VI through IX describe ecological resources, historical preservation, aesthetic resources, and water quality and related requirements.

Other Social Effects

"The OSE account is a means of displaying and integrating into water resource planning information on alternative plan effects from perspectives that are not reflected in the other three accounts. The categories of effects in the OSE account include the following: Urban and community impacts; life, health, and safety factors; displacement; long-term productivity; and energy requirements and energy conservation." (P&G Section VII.1.7.5(a)(1))

The OSE account lends the system of four accounts the flexibility to address any effects that are judged significant by any stakeholder, if the planning team so desires. This is the account that reflects anything that affects the well being

of people. All the difficult issues of equity, income distribution, fairness, and the like are encountered here.

Less has been written about OSE evaluation procedures than any other account. Most of what has been written on this topic with regard to water resource projects dates back to the late sixties and early seventies when inclusion of well-being as a national objective was being debated. One of the best sources for Corps planners is the "Proceedings of the Social Scientists Conference, Memphis 20-24 September 1976" produced by IWR in two volumes dated December 1977.

DISPLAYING EVALUATION RESULTS

The P&G, in Section VIII, provide some general guidance on the nature of graphs, tables, drawings, photographs, summary statements, and other graphics used to analyze and compare plans. Conciseness and clarity are prized most of all. Displays of evaluation results should make the plans contributions to solving problems and seizing opportunities clear. The plans' effects presented in the system of accounts should ideally relate to the plans contributions to planning objectives. The effects of the plans should be so arranged that the differences among the plans will be evident for the comparison of plans that is to follow the evaluation step.

The P&G empower the agency to define report content and format guidance. However, they require: 1) a clear description of existing and forecast conditions without the plan in place; 2) alternative plans should be fully described in terms of their component measures, NED effects and other significant effects; 3) the effects of the recommended plan on natural and cultural resources is to be displayed in detail; 4) a matrix showing other projects or actions related to the recommended plan; and, 5) the formulation process is to be described.

Study documents do not tend to be user friendly. Many Corps reports are intimidating compendiums of minutia written in "Federalese", a dialect incomprehensible to most people. Don't do that. It is often unclear who the intended audience is. The overriding concern seems to satisfy some unquenchable thirst for details, details, and more details. Too often, these details are devoid of context. The story of what was done, and why, is missing.

Many Corps reports are intimidating compendiums of minutia written in "Federalese", a dialect incomprehensible to most people.

Simplicity is what is needed in Corps' reports. Though the problems are wicked and the analyses complex, the telling of the planning story need be neither wicked nor complex. No one can digest a report that is six and one half inches thick. The main report should be as simple as possible and no more so. A document written for an interested member of the public, that makes effective use of displays and focusses

on telling the planners' story concisely and in understandable terms, is what we need. Details can be relegated to the appendices, if necessary at all. Reports are not required to pass along every bit of data and information gathered. Simplify.

SUMMARY AND LOOK FORWARD

Lesson One. Evaluation comprises an objective assessment of plan effects and a subjective appraisal of the assessed effects.

Lesson Two. A most likely with project condition is described for each alternative plan. Effects are evaluated on the basis of a without and with project condition comparison.

Lesson Three. Detailed evaluation procedures have been developed for many NED, EQ, and engineering effects.

Lesson Four. The four accounts provide a detailed and flexible framework for identifying and summarizing plan effects. Plan evaluation provides the basis for reducing the set of potential alternative plans to a set of finalists.

Once plan effects have been evaluated and displayed effectively, they must be compared so planners can identify and describe significant trade-offs to decision-makers who will select the best plan.

CHAPTER TEN: STEP FIVE - COMPARISON OF ALTERNATIVE PLANS

"Nothing is good or bad but by comparison." THOMAS FULLER (1608-1661), English cleric.

"STEP FIVE: COMPARISON OF ALTERNATIVE PLANS." (P&G SECTION III.1.3.2(A)(5))

INTRODUCTION

The objective assessment of plan effects are of limited use until value judgments are made about those effects. Are they good or are they bad? Are they negligible or are they important? Which is the preferred future to steer society toward? Which offers the most desirable set of effects?

Value judgments are made in two parts in the planning process. First, a value judgment is made about the individual plan in the appraisal stage of evaluation. Is it good enough to warrant further consideration? This is the evaluation step. The next step is to make a value judgment across all the plans. This is the comparison of alternative plans, the subject of this chapter.

During the comparison of plans, the differences among plans are examined, weighed and traded-off. Here you will make the final judgments about each plan's completeness, effectiveness, efficiency and acceptability. The basis for the trade-offs and weights given the various plan effects are found in the views of the partners, the study stakeholders, and the community at large. The major tasks of this step are to make a comparison and communicate the findings of that comparison. We begin with the need for comparing plans.

NEED FOR COMPARISONS

A partnership was formed to solve problems and seize opportunities. A set of specific planning objectives was devised which serve as the partnership's reason for being. Plans were formulated to meet these objectives. The plans were individually assessed and appraised. *In the early iterations of the planning process, comparison can be used to eliminate inferior plans from future consideration. If it is clear that a plan is not as good as some others, there is no reason to continue analyzing it. In the later iterations, the comparison becomes more clearly focussed on the*

... "This plan is preferred to that plan."

plans' contributions to the planning objectives. The task of the final comparison is more definitive. Of the final set of plans, is any one best? Is any one worst? If so, what is the basis for that determination? If not, then this is not the final comparison and planning continues.

Starting from a large number of potential plans, screening identifies a set of plans that at least make the minimally acceptable contributions to the overall set of planning objectives necessary to be considered for implementation. Few, if any, of these plans will fulfill all the planning objectives equally. *The purpose of the comparison step of the planning process is to say, "This plan is preferred to that plan."* Further, it is to say which plan is best and why. At this stage you are comparing only the best of each of the different kinds of solutions. From this process we hope the best plan will emerge.

The comparison is to make explicit the contributions of the various alternative plans when they are taken together. Until now they have been examined only on the merits of their solitary completeness, effectiveness, efficiency, and acceptability. *Decision-makers must know what is gained or lost in choosing one alternative over another.* The NED plan is determined on the basis of quantified monetary estimates of plan effects. Consideration of other plans will involve consideration of qualitative information requiring subjective judgments. This means the preferences of the various stakeholders must be taken into consideration to reflect the views of those for whom the NED objective is not the most important goal in the study.

COMPARING EFFECTS

Not to overlook the obvious, comparing plans means looking at them and identifying differences. Plan A has lower net benefits than B. Plan B creates more wetlands than C. Of the five plans, Plan D has the highest costs. These are the types of comparisons that should be evident if the evaluation step of the planning process has been successfully completed.

In considering the differences among plans, part of the planner's job is to identify those effects of significance that will be lost to society if one plan is chosen over another. This means the task is not simply to compare a with project condition to a without project condition but it is also to compare the with project effects of all the plans. If Plan B would create wetlands and no other plan would, then not selecting Plan B means society will forego an opportunity to have more wetlands. The comparison should not overlook significant opportunity costs like these.

It really is not so difficult to identify differences once the planner is experienced enough to identify and consider opportunity costs. The difficult part comes in weighing those differences, as when one plan contributes more to one objective and less to another. Suppose, for example, two plans have identical NED contributions and one creates

more wetlands while the other protects bottomland hardwoods. Which is better? How do you compare things that are not comparable?

There are no simple answers. **Professional judgment**, tempered by public opinion, is used most often. When professional judgment does not offend powerful stakeholders this can be effective. When it does offend, professional judgment is a vulnerable basis for comparing plans and making value judgments about how the plans should be ranked in terms of their contributions to the planning objectives.

Determining the NED plan is a simple matter of comparing the net NED benefits of the plans that have been formulated to meet the planning objectives and identifying the plan with maximum net NED benefits. The NED plan assumes the position of the default best plan during the comparison. It becomes the standard against which other plans are judged. In establishing the rank of the other plans, or in trying to justify trade-offs that could support the selection of a plan other than the NED plan, it may be helpful to explore other comparison methods in addition to a professional, judgment-based, trade-off approach. Some of these methods are discussed below.

METHODS OF COMPARISON

Comparison is an iterative process. Comparing plans is part of the screening process that comprises several planning steps. *The comparison component of the screening process during the early iterations can be quite abbreviated.* Frequently, plans are compared without a formal analysis. Ranking plans as better or worse, identifying plans that result in more or less of effects of interest can be sufficient in early iterations. As the planning process moves toward a final array of plans, the comparison should become more formal and analytical.

A good planning process will assure that the NED plan derived from the set of alternatives formulated does indeed make significant contributions to other planning objectives. To do otherwise would render the plan meaningless in terms of its ability to solve problems and capitalize on opportunities. Other plans that contribute a bit more to other planning objectives and a bit less to NED should also be included in the final array of plans.

Throughout this manual we have described a **multi-objective screening** process, as plans are formulated, eliminated, and reformulated based on their ability to attain multiple planning objectives. Plans that make insignificant contributions to the many planning objectives are eliminated from consideration. Plans that are dominated by others in terms of their contributions to the planning objectives are also rejected. *Only plans that are complete, effective, efficient and acceptable in their contributions to the many planning objectives are considered further.*

There are many comparison methods that can be used in multi-objective screening. **Simple description** is perhaps the place to begin. Figure 16 shows an

Figure 16: Effects Matrix

Objective/Effect	Plan 1	Plan 2	Plan 3	Plan 4
Reduce Flood Damages	+7 8	+7 8	+6 8	+8 8
Reduce Potential Loss of Life	+2 10	+2 10	0 10	+3 10
Maintain Fish & Wildlife Habitat	-3 7	0 7	+1 7	+2 7
Enhance Open Space Land Use Opportunities	-1 2	+1 2	+3 2	-2 2
Minimize Relocation of Homes & Businesses	0 5	-4 5	0 5	-6 3

effect matrix, one simple device for showing and weighing impacts. The columns of the matrix are alternative plans. The rows can show either effects or planning objectives. Each cell is divided by a diagonal line. Above the line is the measure of the impacts. A 1 to 10 scale is used to indicate the relative magnitude of the effect (or attainment of the objective). The number may be positive or negative, depending on the nature of the impact. Below the line another number from +1 to +10 is entered to indicate the relative importance of the effect (or planning objective). In both cases, 10 indicates the extreme value. This matrix may be used as is as a summary or it can be used in some of the comparison techniques mentioned below. Alternatively, qualitative values may be used. High, medium and low positive or negative values can appear above the line. Very important, moderately important and unimportant are examples of a value that could appear below the line.

There are more formal evaluation methods. One set of methods includes **monetary evaluation methods**. These methods have focused on refinements of benefit-cost analysis and cost-effectiveness and make comparison a

...monetary evaluation methods...play a critical role in the comparison...

simple and straightforward matter. The range of methods is presented as a continuum in Figure 17. To be useful in multi-objective planning it must be possible to reduce all plan impacts to monetary terms. This is clearly not possible at the present time and many would argue it is not even desirable. Nonetheless, monetary evaluation methods, such as traditional NED benefit-cost and **net benefit analyses**, incremental cost analysis and life-cycle costing, still play a critical role in the comparison of alternative plans.

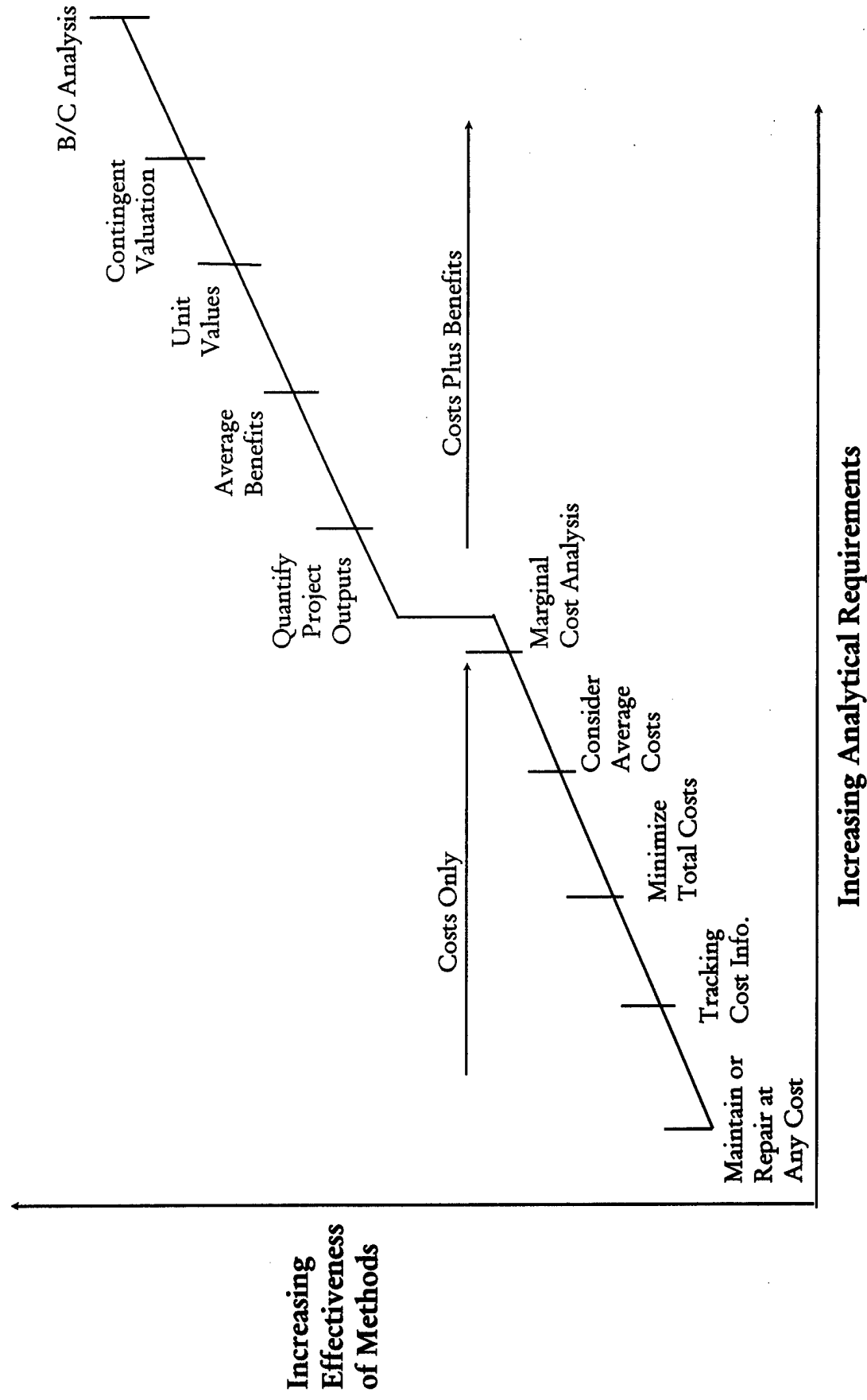
Multi-criteria evaluation methods (MCEM) comprise another class of methods that can be used when it is either not possible or not desirable to express all plan effects in a single metric, such as dollars. Thus, more than one evaluation criterion can be considered with these methods. The strength of these methods is that they enable planners to take into account a whole gamut of differing but relevant criteria when comparing plans. On the basis of this idea of multi-dimensional compromise, a series of MCEMs have been developed in recent years. Many of them are quite complex and we can do little more here than provide the briefest of overviews and a reference for further details.

Trade-off analysis²⁵ is an MCEM method commonly used by the Corps. This method looks at alternative means to attain a set of prescribed goals. The analysis attempts to determine whether one alternative is better than another given the same set of planning objectives. To be done well, this method requires the ability to measure like effects in like units. This method suffers from the same problem as the monetary evaluation methods, however, in that it is unclear how

²⁵ See Edmunds, E. and J. Letey, *Environmental Administration*, McGraw-Hill, New York, 1973 for a discussion.

Figure 17: Monetary Evaluation Methods

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to translate trade-offs into opportunity costs that can be explicitly considered. As a result, this method frequently relies on professional judgment

Planners trade-off plans' various contributions to objectives based on their accumulated technical expertise, general experience, and specific knowledge of the study area including stakeholder views and values. In essence, planners sit down and decide a plan with a little more of this is better than a plan with a little more of that. The trade-offs tend to be subjective.

The **goals-achievement method**²⁶ avoids the problem of a common measure. In this approach, each plan's contribution to a specific planning objective would be quantitatively related to the extent to which that objective has been achieved.²⁷ Each objective (or criterion) is given a weight reflecting its relative importance. An aggregate index of achievement is then calculated for each plan.²⁸ The plan with the highest index of goal achievement is judged best.

The difficulty with this approach is the subjective manner in which the aggregate index is formed. The scale of achievement and the weight assigned are both highly subjective. Because of this, the method may be better suited to providing information than to use as a decision criterion.

There are a great many other methods. **Multi-dimensional scalogram analysis**²⁹ is a generalization and extension of the goals-achievement method. **Correspondence analysis**³⁰ is a method of pattern recognition between alternatives with different characteristics. Using a **principle component analysis** of the row and column values in a plan-effect matrix,³¹ similar to that above, the relationships between certain decision criteria and alternative plans can be examined on the basis of clustering procedures. Conclusions can then be inferred about the desirability of plans.

²⁶ See Hill, M. "A Goals-Achievement Matrix for Evaluating Alternative Plans", *Journal of the American Institute of Planners*, vol. 34, no. 1, pp. 19-29, 1968. Also see the Regional Science Institute's *Planning for Multiple Objectives*.

²⁷ For example, if an objective is to increase wetlands and the most any plan adds to wetlands is 500 acres, a plan that creates 300 acres would reach an index of $300/500 = 0.6$.

²⁸ If the wetlands goal is given a weight of 10 then the contribution toward the aggregate goal is $10 \times 0.6 = 6$.

²⁹ See Hill, M. and Y. Tzafir, "Multi-dimensional Evaluation of Regional Plans Serving Multiple Objectives", *Papers of the Regional Science Association*, vol. 29, pp. 139-165, 1972.

³⁰ See Spliid, I. "Use of Correspondence Analysis in a Planning Procedure for Local Governments", Paper Third Advanced Karlsruhe Summer Institute in Regional Science, Karlsruhe, 1974.

³¹ In such a matrix the plans form the columns (or rows) and the measured impacts form the rows (or columns). Each cell is a specific measured impact for a plan. Qualitative variables must be converted to nominal numerical values.

A **discrepancy analysis** sheds some light on the relative merits of a certain alternative, like the NED plan. This approach measures the difference between the NED plan and each other plan. Ranking the discrepancies among the other plans, a Spearman rank correlation coefficient can be used to establish an ordering of plans.³²

Concordance analysis consists of **pairwise comparison** of alternatives. In the **analytical hierarchical process**³³ (AHP) the objectives are assigned subjective weights and the extent to which plans contribute to these objectives is resolved on the basis of a pairwise comparison of all plans. Indices reflecting these weights are generated and can form the basis for ranking alternatives.

These concordance analysis processes have become very accessible in recent years with the development of user friendly software like Expert Choice and Logical Decisions. They are highly recommended to Corps planners as reasonable methods for dealing with multi-objective decision-making.

Additional methods include the **dominance criterion**, **maximin criterion**, **maximax criterion**, **conjunctive method**, **disjunctive method**, **lexicographic method**, **elimination by aspect**, **simple additive weighting**, **weighted product**, **TOPSIS**, **ELECTRE**, and the **median ranking method**. A description of these methods and a good list of references can be found in Yoon and Hwang's 1995 monograph *Multiple Attribute Decision-Making, An Introduction*.

Despite the abundance of multi-criteria evaluation methods, trade-off analysis based on professional judgment remains the most common method. If comparisons based on seat-of-the-pants methods like this yield the best plan, there is no need for anything more complex. For those interested in doing more work in complex decision settings, we suggest using some of the commercially available decision software and investigating Yoon and Hwang's monograph.

WHAT ARE COMPARISON RESULTS?

The Corps' six-step planning process gives us an orderly way to think about how planning proceeds, even if the actual planning is not so orderly. It is difficult to argue persuasively that a plan is not selected until after all the other planning work is complete. With the overlap and multiple-iterations of the planning steps, experienced planners can often recognize the plan that will ultimately be selected well before the formal plan selection step. What then are the results of this comparison of alternative plans step?

³² Nijkamp, P. "Stochastic Quantitative and Qualitative Multi-Criteria Analysis for Environmental Design", *Papers of the Regional Science Association*, 1977.

³³ See Saaty, Thomas L., Luis G. Vargas, and Kevin P. Kearns, *The Analytical Hierarchy Process 4 Volume Set*.

First, when dealing with NED-oriented planning efforts, a true NED plan must be identified. This is the default choice. That is, unless a compelling case can be made, based on multi-objective trade-offs of other planning objectives, the NED plan will be selected. The comparison must make a persuasive argument for ranking any plan(s) ahead of the NED plan. That can be done in any way the planners prefer so long as it is based on a comparison of the evaluation results. Once again, it is the planners job to tell a story. In this case, the story is why Plan A is better than the NED plan.

Second, the comparisons should be made explicit. **Simple comparisons** can be straightforward statements like "Plan A is best because it maximizes net NED benefits." Simple comparisons will be more appropriate for continuing authority programs and more abbreviated planning processes. More **complex comparisons** will offer either objective or subjective rankings of the final array of alternatives. These comparisons, whether simple statements or complete rankings, effectively represent the study team's recommendations based on their experience throughout the planning process.

These complex comparisons may begin by ranking each plan first, second, third, etc. according to its contribution to each planning objective. These planning objective contributions can then be traded-off based on the relative importance of each objective to the study. Thus, a plan that ranks high in its contributions to the most important planning objectives would rank higher than a plan that doesn't. This is a simple variation on the effects matrix in Figure 16.

Third, the comparisons must be objective. Despite our attempts to present the planning process as a scientific journey of discovery, the reality of the situation is that some studies begin with a **favorable alternative**. In others, a favored alternative can emerge at any point in the study. There is nothing inherently wrong with the appearance of a favored alternative on the planning scene.

*...tell people
which plans
are best and
why.*

A problem arises if the planning process is manipulated to justify the selection of a favored plan. If the planning process is conducted in a professional, conscientious and thorough manner and the favored plan prevails, then it was clearly favored for good reason. However, the planning process must be objective. Favored plans can persist only when they are the best alternative from among a strong set of alternatives. To assure the integrity of the planning process, a rigorous comparison of plans is essential.

COMMUNICATING RESULTS

If the comparison involves professional judgment and trade-offs they won't necessarily be obvious to everyone. The planning report must be able to tell people which plans are best and why. The planner is once again a story teller. How did you compare the plans to one another? What things did you look at? Which were

most important? Why? How do you rank the plans? What were your criteria? What trade-offs are worth making? Why do you feel that way?

Rather than rely on stiff report style writing, try to tell a story with a beginning, a middle, and an end. Write so readers can understand. Save the details for appendices. Simplify.

SUMMARY AND LOOK FORWARD

Lesson One. Plan evaluation determines whether a plan is good enough to consider for implementation. Plan comparison rates all the plans considered for implementation against one another.

Lesson Two. Comparisons can be qualitative or quantitative. There are many ranking techniques available. A trade-off analysis based on professional judgment is most often used.

Lesson Three. The NED plan is the plan against which all alternatives are measured. The comparison must be explicit and objective. The results need to be communicated clearly.

Finally, the comparison results should rate or rank the plans, identifying the best plan and the reason it is best. Generally, plans will be compared and ranked on the basis of their relative contributions to the planning objectives, with the NED objective first among them. If there is a **locally preferred plan**, the basis for the local preference should be explained.

Though planners may do an exemplary job throughout the planning process, up to and including ranking the plans based on professional and public views with strong arguments for the rankings, decision-makers still select the plan for implementation. Selection of the recommended plan is the subject of the next chapter.

CHAPTER ELEVEN: STEP SIX - SELECT RECOMMENDED PLAN

"GIVEN A SET OF VIABLE ACTION ALTERNATIVES," THE ANALYST ASSURES US, "I'LL ASSIST YOU IN SELECTING THE BEST CHOICE OR I'LL RECOMMEND THE BEST SOLUTION." FROM MILAN ZELENY'S *Multiple Criteria Decision-Making*, p. 100.

STEP 6: SELECTION OF A RECOMMENDED PLAN BASED UPON THE COMPARISON OF ALTERNATIVE PLANS. (P&G SECTION III.1.3.2(A)(6))

INTRODUCTION

Plan selection can be one of the easiest step in the process if the other steps have been done properly. The planning process leads to identification of alternative plans each of which could be selected as the "best" plan. The evaluation step assures that each remaining plan is good enough to implement.

In all but the last iteration of the planning process, selection is part of the screening process. Planning iterations continue until it is no longer possible to develop plans that do a better job of meeting the evaluation criteria. In the final iteration, a recommended plan is selected. Doing nothing is the default action in this final iteration. That is, the plans must clearly establish a basis for taking some action. Assuming some action will be taken as a result of the planning process, the default plan is the NED plan. In fact, the P&G have the following to say about plan selection:

"The alternative plan with the greatest net economic benefit consistent with protecting the nation's environment (the NED plan) is to be selected unless the Secretary of a department or head of an independent agency grants an exception when there is some overriding reason for selecting another plan, based upon other Federal, State, local, and international concerns." (P&G Section X.1.10.2(a))

The **decision-makers** and study team are not the same people. The two groups may make different subjective judgments about the importance of different evaluation and comparison elements. They may agree or disagree on which plan is best.

To better understand the plan selection process several of its important elements are discussed below. We begin with the NED plan and the unique role it occupies in the planning process. Then we consider who the decision-makers are. Next comes a discussion of what they are being asked to choose and from what

they are choosing. Some selection criteria are discussed along with the need to tell the selection story before the chapter concludes with a consideration of why plans fail.

THE NED PLAN

One of the plans formulated in the planning process must be designated the NED plan. This is the plan that maximizes the excess of NED benefits over NED costs, i.e., it maximizes net NED benefits. *From a Federal perspective, the NED plan is the preferred plan because it makes the greatest contribution to the one Federal objective.* Although that Federal objective is the planning team's goal, there are many planning objectives of more immediate interest to the partnership that must be met in pursuit of the NED goal.

The NED plan...must be presented.

The NED plan is the only plan that must be presented. Clearly it is impossible to identify the plan that maximizes NED benefits and satisfies planning objectives and constraints if there has not been a logical search for it. Although only one plan may be described in detail it would never be appropriate to consider only one plan. Furthermore, the NED plan is rarely going to maximize net NED benefits globally, that is it will not be an absolute maximum. It will more often be a local maximum, meaning of the plans investigated this was the one that maximized net NED benefits. In order to assure the local maximum is a reasonable approximation of the absolute maximum it is essential that the plan formulation process be comprehensive, reasonable and well documented. The comparison of plans upon which the designation of the NED plan is based will be limited. It is essential therefore that the planner be able to tell the story of how the final array of plans was arrived at and how the comparison proceeded.

With this emphasis on the NED plan planners could come away with the impression that the study team can only respond to the NED goal. Nothing could be farther from the truth. The study team can and should consider the many other planning objectives and effects. The fact that, in practice, much planning emphasizes NED impacts, should not be confused with the fact that good planning demands the Corps consider other objectives as well.

Frequently, the non-Federal partner will find it in their interest to pursue a plan that sacrifices some NED net benefits for additional contributions to other objectives. Clearly, if a plan other than the NED plan is more complete, effective, efficient, and acceptable, it deserves serious consideration for selection and implementation. An NED plan may contribute less to or to fewer planning objectives than another plan. The non-Federal partner may have a strong preference for another plan. When the non-Federal partner prefers a plan that is not the NED plan that plan is designated the **locally preferred plan**.

"Buy-downs"...are...normally granted deviations.

Current Corps policy allows deviation from the NED plan when there are overriding and compelling reasons for doing so. When the NED plan is not the recommended plan it may provide the basis for cost-sharing more costly plans. "Buy-downs", i.e., the preference for a plan less costly than the NED plan, are, according to Corps guidance, normally granted deviations. "Buy-ups" or larger more costly plans are exempted if the non-Federal partner bears all the costs in excess of the NED plan costs. A larger, more costly plan, must have outputs similar in kind and equal to or greater in magnitude than the NED plan to be selected. In such a case the NED plan is important because it determines the basis for plan cost-sharing.

WHO SELECTS THE PLAN?

The principles of the partnership are the decision-makers who will make the selection of a recommended plan. Their actual identity will vary from study-to-study. The Corps' decision-making process is hierarchical as one would expect in a military organization. The decision process can however be bottom up or top down.

In a bottom up process the study team basically makes a judgment about which plan is best in consideration of all the analytical results and with substantial support of the stakeholders. The team then embarks on a journey of persuasion in which they convince their supervisors, the District and Division Engineers of the correctness of their decision. The process proceeds through Corps Headquarters to the Secretary of the Army where formal, final approval is provided or denied by the Federal partner. Alternatively, the decision may be made by the senior managers of the Federal and non-Federal partnership agencies. The locally preferred plan, for example, may be identified by the non-Federal sponsor.

The decision-makers who select a plan from among the final set of alternatives are not the planning team. The planning team does the planning and sets its results before the decision-makers. The comparison of plans in step five represents the team's de facto recommendation. The decision-makers review the team's work and make a selection from among the final set of plans, either confirming the team's judgment or providing their own, which may lead to a different recommendation.

If the planning team has had access to the key decision-makers and has communicated with them throughout the planning process the evaluation and comparison of plans will reflect the decision-makers' views. In other cases, the decision-makers priorities may not be explicitly known. Their positions tend to be much more susceptible to political winds that can change serendipitously. When this is the case, decision-makers may or may not agree with the study team's findings. The decision-makers may select any plan from among the final array for implementation.

If decision-makers concur with the judgments of the study team's evaluation and comparison, the reasons for the selection will be evident. If they disagree and recommend another plan they must provide their rationale for doing so. *A rational planning process should lead to rational results.* From the vantage point of the decision-makers, the study team may have been unaware of certain external considerations, for example, changing political climates and changing priorities. Decision-makers may differ in the significance they attach to the various planning objectives. These rational reasons for deviating from the study team's findings should be documented in the description of the plan selection.

THE CHOICE SET

In the final iteration of the planning process, decision-makers are presented with a final array of plans. These are the plans that have survived all previous iterations of the planning process. They have all been assessed and appraised and found to be complete, effective, efficient and acceptable. *Any of them is a viable candidate for implementation.*

The final array may consist of different alternatives or it may now be down to several versions of a single alternative. There is nothing wrong with a final array that consists of more or less of a single alternative as long as this array emerged from thorough and rigorous formulation, evaluation and comparison processes. Whether there are numerous versions of alternatives or only one of each, the dimensions of the final array of plans should have been optimized.

*No action is
the...starting point.*

The no action alternative will always be an option in the final array. No action is the decision-makers starting point. If they cannot be convinced that what one gains from a plan is worth what one gives up, then they must take no action. Thus, the first decision is should we take any action at all?

If the answer to that is positive, and we would expect that it would be if some plans have survived to this point, then the default recommendation is to implement the NED plan. This is what the partners are to do unless they can offer good reasons for doing otherwise. The most effective tool for making any other recommendation will be the results of the evaluation and comparison of plans offered by the study team. The study team's description of the comparison or the rankings offered constitute information the decision-makers will combine with their own judgments about what plan is best in order to arrive at their recommended plan.

SELECTION CRITERIA

The introduction to this chapter makes the P&G's selection criteria very clear. Choose the NED plan unless you've got a real good reason not to! To choose a plan other than the NED plan the decision-makers must offer a convincing rationale that the NED gains sacrificed or the additional NED costs incurred by deviating from the NED plan are more than offset by the other plan's contributions to other planning objectives.

That NED effects are preferred but not required is an important point. *The Corps' emphasis on the NED effects of plans over the last decade have left some planners with the erroneous impression that NED is the only basis for plan selection. Nothing could be farther from the truth.* Plans must be developed to address all the planning objectives. Trading-off the plan's varying contributions to the different objectives allows for the recommendation of a plan other than NED. Favoring plans that minimize certain potential effects like loss of life or catastrophic accidents over the NED plan may also lead to a locally preferred plan that is a buy-up or a buy-down.

It is widely recognized that not all important project outputs are commensurable in dollar terms. Beneficial effects of ecosystem restoration projects need not, in fact cannot in most cases, be expressed as NED benefits. In the absence of NED benefit estimates, cost-effectiveness, i.e., attaining the given outputs at the lowest possible cost, remains an important NED-related criterion. In the case of some environmental projects, cost-effectiveness extends all the way to an incremental cost analysis. In other cases, however, no NED plan selection is required. For example, although an NED analysis is still required, the NED plan need not be specified nor selected for environmental restoration. The selection criteria for these planning activities will be based on contributions to planning objectives other than NED.

There is no way to escape the reality of the central importance of the NED objective. It is mandated for the Corps. However, NED effects are not the only effects and planners and decision-makers both must bear in mind the leeway they do have to deviate from selecting the NED plan.

DOCUMENTING THE SELECTION

A repeating theme in the last few chapters is the importance of documenting the decision process. Problems, opportunities, existing conditions and forecasts can be described with facts and data. They are easier to document than a rather circuitous decision process. Nonetheless, it is absolutely essential that that decision process be carefully and adequately described. Explain what was done and why it was done. Just tell your story as simply as possible and no more simply than that.

WHY PLANS FAIL

Many plans have been produced and never implemented. Many good plans have failed simply because the obstacles to implementation could not be overcome. *There are four main reasons why plans fail.* The Corps' planning process has developed over time so as to go a long way in avoiding all of these generic pitfalls. Because no process is foolproof, the reasons follow below.

The first reason is not complicated: the plan is flawed and should not be implemented. Not all plans are good plans. The planning objectives may have been incorrect. Planners may have misunderstood the problems or needs of the community. The plan may have been incomplete, not having anticipated that some things necessary for implementation were not possible. It may have overlooked laws and be illegal to implement.

There could be errors in the cost or benefit estimation. The plan could just be a bad idea. Flawed plans emerge from a flawed planning process. This is an avoidable error. The Corps' six-step planning process provides a formal framework which, if followed carefully, should always avoid flawed plans.

*Public attitudes
can change.*

The second reason plans fail is that during the time between plan selection and implementation, circumstances change. Financial and economic circumstances may be different. National priorities change as we see in the history of water resource development. Problems and opportunities change and so might the objectives of locals.

Key supporters leave. Stakeholders change position, or special interests gain power. Public attitudes can change. Events like a dam failure may give opponents a rallying point. Alternative uses for resources may arise. Any of these can be enough to turn support into opposition. The Corps' iterative process can be very responsive to changing circumstances and its reevaluation reports are specifically to consider such changes in conditions.

A third reason plans fail is that they are never funded. We live in a world of increasingly scarce resources of all types and at all levels of government. A perfectly good plan with strong support may not be implemented because one of the partners is unable to provide their share of the financing. This may be due not so much to changed priorities as to higher priorities. There may be better plans to be funded, though this one is good. There may be other human wants and needs that require attention and funding first. There is rarely enough money to do everything. The project cost-sharing agreement and accompanying financial analysis limit the potential of this kind of failure.

The fourth reason plans can fail is that the implementation is blocked. If implementation requires the approval of the partners and that approval is not forthcoming, the plan will fail. Plans that do not receive the support of the Secretary of the Army or the Office of Management and Budget will not be

implemented. Plans that do not receive approval by local authorities will not be implemented.

A plan may be incompatible with the other commitments of one of the partners. Water supply contracts may render plans infeasible. An agency may prefer other programs. There may be a good acid mine drainage plan that emerged from a study but the local district may fail to find support for such an initiative within the agency or the Administration. There may be lack of support due to other commitments. A change in the Corps' priority outputs may render a good plan dormant.

There may be a lack of support due to lack of interest. A local government may have no interest in supporting a nonstructural flood damage reduction plan. There may be disagreements among institutions as to their proper roles, i.e., who runs what. There could be agreement but with a lack of power needed to mobilize the resources needed for implementation. These approval points can be foreseen but they cannot be controlled. They remain unavoidable risks. An open and informed planning process can go further to avoid this kind of failure than any other step.

SUMMARY AND LOOK FORWARD

Lesson One. Planners and decision-makers are not the same people. They may agree or disagree on which plan is best.

Lesson Two. Any plan in the final array of plans should be good enough to implement. If it's not, it should have been eliminated by the screening process.

Lesson Three. Taking no action is the first default decision. If action is desirable, then decision-makers are to select the NED plan unless they have a good reason for doing otherwise. If they do otherwise, make sure the good reason is clearly explained.

Now that we've reviewed the theory, history and current status of the planning process, we want to take a look at the future of planning. We begin with a look at one of the emerging new national priorities, the environment. The next chapter looks at the Corps' growing role in planning for the environment.

CHAPTER TWELVE: PLANNING AND THE ENVIRONMENT

"WE do NOT INHERIT THE LAND FROM OUR ANCESTORS; WE BORROW IT FROM OUR CHILDREN." NATIVE AMERICAN PROVERB.

INTRODUCTION

Environment means many things to many people. This chapter discusses the Corps' evolving role in environmental restoration which has lead to revived interest in watershed planning. Planning for the environment may introduce some new terminology but it is the same process described in the preceding eleven chapters.

"Environmental planning", though an expanding Corps mission, is nothing new. In fact, a case could be made that the Corps has always been involved in environmental planning, it's just that the desired adjustments to the environment have evolved and changed over time. Environmental planning warrants a chapter in this manual because many people view it as a new mission.

*Environmental values
have long been reflected...*

Environmental values have long been reflected to varying degrees in water resource development projects. They were first formally expressed in the Conservation Movement, early in this century. Described briefly in Chapter Three, this movement sought the conservation of natural resources through the development of efficient energy sources. At the time, that meant hydropower. Much of the water resource development through the middle of this century was at least in partial response to the environmental values expressed in this early movement and by the preservationists who were gaining in influence.

The Conservation Movement gave way to the Preservation Movement. As environmental scientists and environmentalists became more sophisticated in their knowledge and understanding of the environment the focus shifted from the wise use of some resources to conserve others to the preservation of basic environmental values.

In the third quarter of this century the environmental focus shifted to pollution and the preservation of species. The Clean Air and Clean Water Acts were significant expressions of these shifting priorities as was the landmark National Environmental Policy Act. Eutrophication of lakes, rivers unsafe for human contact, fish kills, smog alerts, threatened and endangered species, and threats to human health were among the issues that pushed their way onto the

agenda of the American public. Water resources planning changed to reflect these changing priorities.

More recently, the environmental movement has evolved in its sophistication. Though the old issues of energy, pollution and preservation of species have far from disappeared, new issues of **ecosystem function**, **bio-diversity** and **sustainable development** have arrived on the public consciousness. These values have found their way into water resources planning.

The chapter begins with a conceptual overview of environmental planning that includes some different types of environmental planning activities in which the Corps is involved. The effect of environmental legislation on Corps programs is also briefly considered.

WHAT IS ENVIRONMENTAL PLANNING?

During the course of preparing this manual numerous experienced Corps planners were interviewed and asked, "What is environmental planning?" Based on the responses there is no uniform agreement on or understanding of just what environmental planning is. "It's like the story of the blind man and the elephant," one planner opined, "how you describe it depends on how you approach it." And, so it may be. Nonetheless, this chapter focuses on the positive aspects of environmental planning.

"Environmental planning" may be something of a misnomer. Although there are environmental planning objectives and new environmental programs and authorities, the simple truth is the planning for and about these values is the same planning process described in the last six chapters. It's more accurate to say that increasing national interest in and importance of environmental values is receiving new emphasis in the water resources planning process, rather than to suggest that "environmental planning" is something new.

*...environmental
assessment...became a
formal necessity...*

The Corps' contributes to the preservation and restoration of the Nation's environment through its programs that evaluate environmental quality effects of its projects and actions, fish and wildlife mitigation and restoration, and restoration of the environment. These three activities are discussed in the following sections.

EVALUATION OF ENVIRONMENTAL QUALITY EFFECTS

*There are different types of planning activities Corps planners do that relate to the environment. First, there is the evaluation of environmental quality effects of alternative plans. This is referred to as **environmental impact assessment**. An environmental assessment (EA) may lead to a finding of no significant impact (FONSI) or an environmental impact statement (EIS). It became a formal necessity*

for the Corps with the promulgation of the Council on Environmental Quality regulations following the passage of NEPA. This type of environmental planning has been done for over two decades and the methods are well defined and well executed.

Chapter III of the Principles and Guidelines addresses environmental quality procedures. The purpose of that chapter is to describe a method for identifying and describing beneficial and adverse EQ effects of alternative plans. Just as there are specific procedures for estimating NED benefits and costs there are specific methods for estimating environmental quality benefits and costs, though the measurements are not generally monetary. Chapter 7 of ER 1105-2-100 repeats the P&G procedures and includes additional guidance of environmental planning, it's the best source of guidance on these procedures.

The P&G give meaning to important terms like EQ attributes, EQ resources, indicators, significance and other concepts important to the evaluation procedures. Of particular note are the general evaluation requirements which stress the same basic tenets of good planning as found in the Principles and Standards of the P&G. The EQ procedures are carefully related to the requirements of the Council of Environmental Quality NEPA regulations, hence the language used varies at times from the language of the six-step planning process. There is no

effective difference between the two, however. Table 30 summarizes the steps of the EQ evaluation process.

Table 30: EQ Evaluation Activities

1. Identify resources
2. Develop evaluation framework
3. Survey existing conditions
4. Forecast without-plans condition
5. Forecast with-plans condition
6. Identify effects
7. Describe effects
8. Determine significant effects
9. Appraise significant effects
10. Judge net EQ effects

Evaluation of the EQ effects of alternative plans is an ordinary part of the evaluation step in the planning process. This is simply the assessment and appraisal of effects of alternative plans that are relevant to the EQ account and environmentally oriented planning objectives. It is exactly equivalent to the estimation of the NED effects of alternative plans. The procedures for estimating the two sets of effects just happen to be different.

FISH AND WILDLIFE MITIGATION AND RESTORATION

Section 661 of the Fish and Wildlife Coordination Act of 1958 provided that fish and wildlife conservation receive equal consideration with other project purposes. Section 906(a) of WRDA '86 authorized mitigation of unavoidable damages to fish and wildlife that result from construction of a project. Section 1135 of WRDA '86 makes restoration of fish and wildlife habitat possible.

Although enhancements may have been treated as incidental to the "primary" purpose of many projects in the early years, it is no longer the intent that they be handled in this way. Mitigation was often treated as an afterthought. After all the plans were formulated, the NED plan identified, and the best plan selected, environmental specialists were tasked to come up with some measures to mitigate the plans adverse impacts on fish and wildlife. To further complicate matters, fish and wildlife mitigation measures introduced planners to the realities of planning that was not NED-oriented. Analytical tools were not readily available to estimate the monetary and non-monetary effects attributable to mitigation measures. *Planners continue to struggle with the idea of how best to handle non-NED oriented planning in an NED-oriented planning process.*

Cost-effectiveness and incremental cost analyses are methods used to facilitate a comparison and analysis of the relative value of additional increments of mitigation output. Together they are a compromise between cost oblivious decision-making and decisions based on benefit-cost analysis. A method for conducting the analyses is described in *Cost Effectiveness and Incremental Cost Analyses*, IWR Report 95-R-1, Interim Manual.

The changes introduced by the requirement to do mitigation planning caused some problems. It was unclear, at first, whether mitigation was intended to be added on after the planning process was completed or whether it was to become a requirement of the planning process. It is the latter. No one knew how to justify the recommended mitigation in an NED-oriented process when the value of the mitigation could not be reliably expressed in monetary terms. That is a problem that is easing as a result of the cost-effectiveness and incremental cost analyses but that is not yet solved. As a result of the experience with mitigation planning, however, planners are no longer floored by the notion of measuring outputs in ways that are not amenable to monetarization. They may be frustrated and bewildered, but the idea no longer shocks them.

ENVIRONMENTAL RESTORATION

Restoration of degraded ecosystem structure, function, and dynamic processes represents a new challenge for Corps planners. This program is unique in the fact that it offers an objective that is not NED-oriented.

Section 1135 of WRDA'86 (P.L. 99-662) authorizes the Secretary of the Army to modify Corps projects for the purpose of improving the quality of the environment in the public interest. EC 1105-2-206 provides guidance for implementing this authority. The Section 1135 Program objective is as follows:

"The objective of the project modification should be restoring degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition, which will involve

consideration of the ecosystem's natural integrity, productivity, stability and biological diversity."

While the Section 1135 Program focuses on improvements to existing projects, the Corps' broader ecosystem restoration program provides additional opportunities. Recent guidance in EC 1105-2-210 states:

"Ecosystem restoration activities examine the condition of existing ecosystems, or portions thereof, and determine the feasibility of restoring degraded ecosystem structure, function, and dynamic processes to a less degraded, natural condition. Ecosystem restoration provides a more comprehensive approach for addressing the problems associated with disturbed and degraded ecological resources than does focusing only on fish and wildlife habitat."

Environmental restoration is not a brand new challenge to planners. Rather, it presents the opportunity for planners to do what they always have albeit with greater emphasis on environmental values. In this respect it is no different from other programs that have been created over the years.

*...less emphasis on
NED effects...*

SUMMARY

New objectives and new programs can present the need for changes in the details of how planning is done, but the basic process, the six-steps, are exactly the same. The steps are robust enough that changes in the evaluation process, e.g. less emphasis on monetary measures; and comparison process, e.g., less emphasis on NED effects, are easily accommodated. Environmental planning is, then, nothing but good planning that incorporates a special emphasis on the environmental problems and opportunities of the study area as reflected in the planning objectives.

The evolving importance of environmental values has been reflected in new authorities like Section 1135 of WRDA'86, the elevation of restoration and protection of environmental resources to priority output status, and similar changes. There is a temptation to look at these new developments and label them environmental planning, but we prefer to think of these developments as part of the continued evolution of good water resources planning that continues to reflect changing national values as it always has. Seen in this light, the changes are business as usual and there is no need for new planning paradigms.

ENVIRONMENTAL VALUES AND THE CORPS

How does the Corps address these changing national values in its programs? Environmental laws, like NEPA, have over the years had a profound effect on the program of the Corps. The P&G provide specific procedures for evaluating environmental quality effects. New program authorities have extended the Corps abilities to address some environmental concerns. A renewed interest in finding ways to address environmental values in existing programs is also underway. These are some of the ways that environmental values work into the Corps' program.

The P&G and Corps guidance have been discussed at length in various places throughout this manual while environmental legislation has not. The Institute for Water Resources is preparing the *Environmental Desk Reference*,³⁴ a compendium of environmental laws relevant to the Corps' Civil Works program. The impact of these laws on the Corps' programs are too far reaching to address in this manual. The *Environmental Desk Reference* will provide an excellent source of information about the impacts of these laws and EO's on the Corps' programs, however. The impacts of some of these laws, like the Fish and Wildlife Coordination Act and NEPA, are well known and are discussed in this chapter.

SUMMARY AND LOOK FORWARD

Lesson One. The Corps' environmental mission has grown and evolved over time. There is now a priority commitment to that expanded mission.

Lesson Two. The newer environmental missions do not require a traditional NED analysis. The restoration mission is driven by a different Federal goal of restoring degraded ecosystem function.

Environmental values are emerging as a new national priority, but the Corps has been involved in environmental planning for over two decades. Although the environmental missions and authorities are changing and evolving, the process for dealing with many of these problems is firmly in place in the Corps' planning process.

To this point, we've tended to idealize the planning process. The next chapter considers some of the practical considerations that can arise and keep planners from realizing these ideals.

³⁴ At the time of this writing the May 1994 desk reference was in review draft form. It is possible that the final version of the reference will be known by a different name.

CHAPTER THIRTEEN: PRACTICAL CONSIDERATIONS

"SOME HORRIBLY INCONCEIVABLE THING HAPPENS!" ADAPTATION OF A
POPULAR BUMPER STICKER.

INTRODUCTION

*...planning...can be...a
formless process.*

The planning process described in this manual may be quite foreign to experienced planners. "It doesn't happen like that," they might say. And they would be right. This chapter looks at some of the practical considerations that can cause planning in practice to deviate from the ideals of this manual.

PLANNING CAN BE A MESSY PROCESS

The planning process described herein has been an ideal, a goal for planners to try to achieve, a model to follow. What happens in practice can vary drastically because the planning process is a complex one. It can be, despite the structure offered in this manual, a formless process. Planning has been described as a series of iterations of the six-step planning process. It's not that simple.

Planning begins where it begins. Planners may start at ground zero with little more than the name of a community with a problem. In other cases, they may begin with the benefit of a reconnaissance or a feasibility report. Still other studies begin when a non-Federal partner presents a plan they would like help implementing.

The work proceeds quite a bit more randomly than this manual might suggest. Problems described by people lacking knowledge of natural systems may take quite awhile to understand. Just when you're finishing up your H&H work along comes another flood to change your rating and frequency curves.

Plans can be changed by unexpected incidents. The most promising and popular alternatives formulated may have to be dropped late in the study because foundation surveys found unconsolidated fill at the project site. An analyst may have mistakenly used the frequency curve from one reach with the rating curve from another making a plan that actually did nothing to reduce flood damages look very good. Everyone has stories about "busts" in the cost estimate. Horror stories about how crass political considerations aborted some really creative planning abound. Countless plans have been hindered because she thought he knew what she meant when she asked for the work she needed him to do.

These little slices of reality are not unique to planning. These are the messy facts of life for anyone dealing regularly with wicked problems. You just have to deal with them the best you can. It is the messy processes that need structure most. It is precisely because planning is so messy that the iterative six-step planning process is so valuable.

Problems with the Problems

Some years ago a Corps study had advanced substantially along in the planning process. Plans had been formulated to develop flood damage reduction alternatives from a main stream and one of its tributaries in an urban area. The main stream had a long, well-documented history of flooding. The tributary was a small stream. The county engineer reported a coincident flood of surprising magnitude on this stream during the main stream's flood of record. As the study team believed it was nearing the end of plan formulation they learned that the tributary flooding was actually backwater from the main stream. Formulation would have to start all over to do the job right.

Sometimes the problems are hard to understand.

CHANGE IS THE ONLY CONSTANT

Fifteen years or so ago, recreation specialists were at the top of the Corps' most wanted employees list. Today, recreation is not a priority output. One day you're making progress on a study and the next day national debate seems to suggest changes that will substantially change the mission. What is a planner to do?

Planners deal with the wants and needs of people. Corps planners are public servants who are more vulnerable to changing national priorities and politics, both national and local, than many other professional planners. Recognizing these simple facts, a good planner learns to expect change. It comes with the job. As a matter of fact expecting change in the working environment is good practical experience for

planners who are asked to anticipate and forecast changes in their planning areas. Chapter Three provided general details on some of the changes that have occurred in our Nation's two centuries of involvement with water resources development. Missions come and go, but the need for planning remains.

Anticipate changes by staying current in your field, as a planner, and as a Corps employee. Learn as much about the changes and their implications as quickly as possible. Adapt to change when it comes. Look on it as an opportunity to do new things or to do things differently. Follow these simple suggestions and change becomes an opportunity rather than a threat.

PLANNING BIASES

We are all the result of our own experiences. Each of us is biased to some extent by our culture, how we grew, where we worked, and what's happened to

us. Experience is a cruel master. Inevitably, we find some things we always do and others we never do. We all have our biases, i.e., mental leanings or inclinations that leave us with definite ideas about a matter that is no longer open for consideration. Planners are no different. If they've had a bad experience with something in the past, they're inclined to avoid it in the future. They, like others, tend to repeat things that have succeeded in the past.

Experience is a cruel master.

The Corps itself has a unique institutional culture. As a quasi-military organization there is great value placed upon tradition, honor, control and predictability. There is also a tendency for certain biases to arise. Biases are not necessarily a bad thing. We all become biased against danger as we grow up, its an

effective way to survive. We're not concerned here with the biases that help planning succeed. Rather, we're interested in considering some of the biases that may limit the extent of our planning.

It's Hard to do a SOW

A point that doesn't really fit neatly anywhere in this chapter but that was too important to ignore is that it is hard to prepare a scope of work. A scope of work is the first formal part of the scoping process. The purpose of a scope of work is to identify the work that will and will not be done during the course of a planning study.

It requires the planning team to not only decide what will be done, but how much and in what manner. For example, will a study require new stage-damage data or will existing data be updated? If new data is to be collected what area will be covered? Will there be a census or a sample? How will the data be collected and at what cost?

Scoping in this fashion is a bit like educated, if not scientific, fortune telling. Mistakes will be made. Unexpected problems will arise. The SOW gives structure to the beginning of the study. Inasmuch as it is part of the scoping process it, like everything else in a planning study, is subject to revision throughout the iterations of the planning process.

During a series of interviews conducted as part of the preparation of this manual, Corps planners identified a number of biases that can limit the success of a planning study. These biases toward doing some things and avoiding others tend to arise as a direct result of the Corps' culture, i.e., its way of doing things. The Water Resources Development Act of 1986, two-stage planning, the P&G's emphasis on NED, and priority outputs designated by the budget have contributed to the development of some biases that have shaped the current state of planning within the Corps. These constraints and others, need to be understood if there is any hope of introducing good planning practices into the pragmatic world in which planners must work. The paragraphs that follow address the two-stage planning process, time and money constraints, limits on authority, cost-sharing, biases in plan formulation, and the non-Federal partner as ever present constraints in the planning process.

TWO-STAGE PLANNING PROCESS

The Corps of Engineers has a well-deserved reputation as a premier construction agency. *Over time it has evolved a two-stage planning process. The first stage is the reconnaissance study.* The reconnaissance study is a preliminary survey to obtain information. In this case, the information is used to make a preliminary determination if there is likely to be a plan the Corps of Engineers can eventually implement. Generally, this means the plan is environmentally acceptable, economically feasible and is within the authority of the Corps to implement.

Reconnaissance studies are entirely at the expense of the Federal government. They must be completed in 12 months, though an extension to 18 months is possible under special circumstances. The reconnaissance has four basic purposes: 1) Identify problems, opportunities and potential solutions; 2) Determine whether to proceed to the more detailed feasibility stage of planning; 3) Estimate time and costs of a feasibility study; and, 4) Ascertain the non-Federal interest in and support for proceeding to a cost-shared feasibility study and project.

The determination to proceed generally depends on identification of at least one economically viable alternative in reconnaissance stage planning. Non-Federal interest is generally expressed through a **Feasibility Cost-Sharing Agreement (FCSA)**.³⁵ *If the reconnaissance stage ends with one or more promising plans for implementation as well as strong non-Federal support for that plan, planning proceeds to the feasibility stage.*

The objective of the feasibility study is to investigate and recommend solutions to water resources problems. Except for single purpose inland navigation projects, these studies are cost-shared 50/50 between the Federal government and the non-Federal sponsor including in-kind credits for the non-Federal partner. Some planners say this two-stage process presents several significant constraints to the six-step planning process.

First, there is the Corps' insatiable appetite for details. Requirements for Corps studies, as expressed in the various sources of official guidance and in the traditions of the agency, are extremely detailed and technical. Planners sometimes feel reviewers are the source of this insatiable appetite. Reviewers sometimes feel plans are lacking in details that are essential for the support of study recommendations.

The dynamic tension between the planners and the reviewers can actually be a positive force. As long as the two groups share a common interest in the ultimate success of the partnership and communicate regularly and effectively, there is a better chance that a proper balance in information needs will be struck.

³⁵ For more information on this two-stage planning process see Chapter 2 of ER 1105-2-100.

Some feel a second and more important constraint arises from the very nature of the two-stage planning process. The reconnaissance may not provide enough time for a thorough and sufficiently detailed application of the six-step planning process. Yet, if the reconnaissance results in a feasible plan, pragmatic concerns of the non-Federal partner can limit the planning process in the feasibility stage. The end result can be that good planning never quite fits into the process.

The reconnaissance is usually 12 months long. It might take a month or two to get the study started, and similar time to write and reproduce the reconnaissance report. If we subtract the start-up and wind-down time from the 12 months, that can leave as little as eight months to do the planning work. That may not be enough time to thoroughly define problems and opportunities, specify planning objectives, formulate alternatives, evaluate and compare them, repeat this process several times and finally make a selection. But, it is plenty of time to do good planning. Sometimes the back-of-the-envelope analysis and professional judgment provide just what is needed to make a decision and move on.

It was never intended that a detailed planning process be completed in the reconnaissance. Its purpose is to determine if there is a reasonable chance there is a plan the Federal government and its non-Federal partner can support. The reconnaissance is done first in an effort to avoid wasting resources on a detailed and costly planning study that would result in no action. Preliminary plan formulation goes on in the reconnaissance stage. The necessary details are to be provided in the feasibility stage.

In the second stage, a more complete planning process can be conducted to assure that the planning team has identified the best plan. Real problems can arise as a result of the pragmatic concerns of the non-Federal partner. Now that feasibility studies are cost-shared, non-Federal interests have a stronger incentive to hold down the costs of a feasibility study. They also have a stronger desire to come away from the planning process with a project implementable by the partnership. This means the planning team may find itself under considerable pressure to stick with the plan recommended during the reconnaissance stage of the study, that formed the basis of the partnership's feasibility cost-sharing agreement.

Considering more plans can cost more money. Considering more plans increases the possibility that the recommendation will be something other than what was agreed upon in the reconnaissance stage. Additional details could also result in the rejection of any recommended plan. As a result of these and other concerns planners might concentrate on the reconnaissance stage plan and do very little plan formulation.

These biases are avoidable.

Don't despair. These biases are avoidable. They arise from an incomplete understanding of the purposes of the two-stages or an improper scaling of the planning process. The two-stage planning process is used to provide order and sanity in the planning process. The six-step planning process provides a rational

approach to solving problems that can actually help planners make the best use of their time and resources in each of the stages. Taking more time to explain and understand the purpose and structure of the planning stages and steps can be a profitable way to begin the study process and avoid some of these problems.

Partners need to understand that the reconnaissance plan is developed without complete information and without full consideration of all alternatives plans and versions of these plans. That is the only way to save resources. Bad plans can be worse than no plans, however, and a thorough investigation of potential plans is required at some point. This must be done in the feasibility stage.

The six-step planning process provides the framework that will make the best use of the information obtained in the initial iterations conducted in the reconnaissance stage as well as structuring the feasibility investigation efficiently. The feasibility stage is not a refinement or a verification of the reconnaissance plan. It provides the time to complete a thorough and comprehensive planning process.

All parties must understand the purpose of the reconnaissance stage is not to identify a plan for implementation but merely to provide evidence of the existence of an implementable plan. It is during the feasibility stage that the best plan is identified.

TIME CONSTRAINTS

Time is a universal constraint. Planning is not exempt from it. Another universal truth is, time is money. The more time something takes, the more it costs. Thus, we have a dichotomous role for time in the planning process. On the one hand there is not enough of it, thus constraining our ability to plan well. On the other hand, we don't want it to take any longer than it must because it increases costs. The partnership needs more of it while they want to use as little of it as possible.

Not having enough time limits the things we can do. With limited time there may be a bias toward smaller more easily solved problems. Complex problems take time to understand and more time to solve. Watershed and non-structural approaches to problems take time. Lack of time can cramp creativity. Traditional solutions to problems save time.

Talking to people takes time. Planners are unable to confer with other professionals about problems when they are pressed for time. Likewise, public participation takes time. Planning takes time. There is no getting around it.

...the back-of-the-envelope may be appropriate.

With a sound understanding of the purpose of and a systematic approach to planning we can make the best use of the time available to us for problem solving. The planning process can be intensified for shorter time frames and expanded for longer ones. Fewer iterations may be possible during short studies. Once again, professional judgment and the back-of-the-envelope may

be appropriate. We may have to work with less information than we would like to have when we are short on time.

In such an imperfect world it is to your advantage to have an organized approach to problem solving. You will never be free of time constraints. If someone didn't say "Time is up", planning would never end. The future never arrives and planning is never finished. The six-step planning process can help minimize the strictures imposed by time.

BUDGET CONSTRAINTS

Knowledge and understanding in planning costs money. Rarely is there enough money to do everything the planning team would like to do to arrive at a decision. When you can't do everything, you have to make choices. Frequently there can be biases in the funding decisions made by the study team. Previous studies and organizational power structures are two of the most common determinants of study budget allocations. Once study funds have been allocated and the work accomplished the results of a planning study can be biased by the data that are available as well as the data that are not available.

Inadequate funding may bias planning studies toward small problems that can be solved with traditional solutions. Creativity may be endangered by budget constraints. It is precisely in settings like these that a systematic approach to problem solving can foster some creativity. The simple structure of the six-steps suggests that creativity is not needed in data collection, evaluation, comparison, or selection as much as it is in establishing objectives and formulating objectives. When budgets are tight this is not the place to cut corners. Do a thorough job here and compensate with more scoping, screening, and professional judgment in the other steps.

There may be occasions when the feasibility cost-sharing arrangement will present a substantial burden to the non-Federal partner. In such cases, the pressure to hold down costs could result in some of the same kinds of biases. *Once again, however, the orderly and predictable nature of the planning process allows the team to anticipate potential problems in the process and think ahead to avoid or overcome them.*

LIMITED AUTHORITY

The P&G provides wide latitude in the types of plans that can be developed, but good plans may be overlooked due to the Corps' lack of authority to implement these plans. There is indeed a disconnect between what Congress and the P&G tell Corps planners they should do and what the agency and Administration tell them they can do. Comprehensive plans addressing community needs may be overlooked in favor of a smaller, more traditional solution because it's often easier to do what you can than it is to do what you should. Nonetheless, good planning remains the best approach to this dilemma.

Pushing the Envelope

There are some recent examples of planning studies that were not restricted by a lack of authority. One district was able to find support for an investigation of acid mine drainage problems identified in a general investigations study. A second incorporated overland transportation needs into its study by drawing the appropriate transportation agency into the planning process. Both these activities were beyond the Corps' authority. The acid mine drainage was a severe problem in the one community and the transportation improvements were a unique opportunity in the other. These are two good examples of comprehensive water resources planning. Sometimes you can leverage the authority you have to get new authorities through specific authorization.

Plans should be comprehensive and thorough, regardless of current authorities. Perhaps another agency can implement what the Corps can't. If the problems and opportunities are sufficiently compelling it is more likely that a way will be found to implement the plan.

Existing authorities can bias plans toward what can be easily done rather than what needs to be done. The authorities become like the planner's hammer and the planner goes looking for the proverbial nail to hit. What is required are planners who can determine what is needed rather than what is possible and who can then find ways to get the job done. By following the six-steps, proceeding carefully and with full communication among all stakeholders, it is sometimes possible to find support among stakeholders or at higher levels in the Corps for innovative plans. Although authority

appropriately biases plans, the planner needs to be willing to fight those biases when the need is great. *When the need is great and support is built carefully, there is almost always a way to get things done.*

COST-SHARING

Cost-sharing is a frequently cited bias in the planning process, although the reality of its occurrence is a little harder to pin down. *The presumed bias is that local sponsors prefer plans that minimize their own costs to the point that better plans might be overlooked in favor of a lower non-Federal share of costs.* For example, open ocean disposal of dredged material may be preferred to upland disposal because the former is less costly to the local sponsor. Some have suggested that buy-downs from the NED plan are motivated more by cost-sharing concerns than contributions to other planning objectives. Others fear that capping project costs may prevent identification of the true NED plan.

If this bias arises after a comprehensive set of alternative plans have been formulated, evaluated, and compared, it presents no real problem for the planner. Costs are a limit consideration of any plan. The lower costs might reflect the sponsors top priority and biases are not always bad. *If a bias toward lower costs means the formulation process is constrained and all potential solutions are not considered, there could be a problem.* Hence, a bias based on cost-sharing becomes a problem only if it restricts the formulation process. The solution would seem

rather obvious, formulate plans without regard to costs and use cost appropriately as a selection criterion in the screening process.

BIAS IN PLAN FORMULATION

The planning process may also be limited by biases planners interject into the planning process. They may have a bias toward past plans; a bias against non-structural plans; a bias against innovation, especially when authority to implement is lacking; a bias toward a preselected solution; a bias toward large rather than small projects; or, a bias toward NED-oriented solutions. Any of these, or other biases, can adversely influence the planning process.

*Objectivity and integrity
are virtues to be prized
above all others...*

There are other, more subtle biases. Now that the non-Federal partner is helping to finance the study, he may have some working assumptions or data he wants used in the study. This presents a problem only when the data or assumptions would not otherwise be used. The most common and significant biases are found in the identification of a most likely without project condition. Objectivity and integrity are virtues to be prized above all others by planners. Protecting them may require additional coordination, sensitivity analysis or other professional accommodation, but there is no room for bias toward inaccuracy in the planning process no matter what its source.

Price Makes a Difference

Before the cost-sharing changes of WRDA'86, the local sponsors of a deep draft navigation study made it clear that there was no point in even considering a channel less than 1,000 feet in width. Anything less than this was unsafe and unacceptable to the pilots, the Coast Guard and the port authority.

Following WRDA'86, when the non-Federal share of costs rose substantially, the non-Federal partner did some soul-searching and with artful coordination among the various interests it was determined that a narrower channel would do very well. In fact, there would be a negligible difference in navigation safety between the 1,000-foot and the 800-foot wide channels according to the pilots, the Coast Guard and the port authority. Surprisingly, cheaper actually turned out to be better.

Some planners perceive a bias toward environmental measures. They sense a notion among some stakeholders that anything environmental is good and worthwhile. If environmental measures are not subjected to the same analysis, these measures could run up project costs and lessen the overall attractiveness of the plan. This is of particular concern in instances where resource agencies or other environmental interests hold an effective veto power over the planning process.

The flipside of this coin is, of course, the enduring bias against incorporating environmental measures in a plan. All too often plan formulation is completed before environmental mitigation is even considered. It becomes an "add-on" to the plan. Mitigation measures should be part and parcel of the planning process just like relocations of

affected homes and businesses. The cure for both these ills is simple: interdisciplinary teams. If all disciplines are included on a study team from the beginning and they function in a truly interdisciplinary fashion, bias toward or against aspects of a plan, or any other aspect of a plan, can be avoided.

There are some more subtle biases as well. During preparation of this manual, several experienced Corps planners said the Corps is not listening to its partners or its customers. It still wants to approach problems as engineering problems. The full range of plans is never investigated because engineering concerns predominate the thought process. Problems are treated as strictly technical issues rather than as the complex technical and social issues they are. Some planners perceive a general bias against planning because many people do not understand or value planning. Some, in and out of the Corps, consider planning a money-consuming waste of time, especially those who believe they already know the problem and the solution as well.

Taking the time to educate Corps personnel, partners and customers about the planning process and its benefits may not make these problems go away but they surely won't hurt.

NON-FEDERAL PARTNER

There is no partnership and no planning without the non-Federal partner. This makes the significance of the non-Federal partner's potential veto of any planning activity very clear. Some of the feasibility study money is the partner's too. If they have no interest in a potential solution, there is a strong temptation to give it no consideration. This may or may not present a problem. The screening process is supposed to eliminate plans that are not good enough to implement. Thus, the simple act of eliminating a plan is not necessarily a problem. The problem arises when potential solutions are rejected out of hand. If a plan has not been developed to the point that it can be eliminated with rational cause, then bias could be a problem.

...planners need to sell...the value of planning.

Too often, the planning process begins with a misunderstanding of what an acceptable plan is. To many planners, a plan that the non-Federal partner does not like is an unacceptable plan. That is not the case. *The "likability" of a plan is a far more subjective characteristic than one might suspect, as the "Price Makes a Difference" sidebar indicated. Partners tend to like reasonable plans more or less rather than yes or no. As circumstances change, the desirability of plans can change as well and planners must guard against eliminating plans from consideration without good cause.*

To avoid this problem planners need to sell the non-Federal partner on the value of planning. It is one thing to convey the necessity of planning, "We're required to do this." It is quite another thing to convince someone that what the Corps' planning process does for them is to protect their investment and assure them that from all the possible solutions to their problems, the very best one is

selected. It is especially difficult when this planning is going to cost them more. But, if you do that, good planning will come a lot more easily.

AVOIDING BIAS

Biases in the planning process are inevitable. Some are more serious than others. The choices for dealing with biases are living with them or eliminating them. *Some of the above biases are simpler to eliminate than others. The starting point in each case, however, is for planners to understand the planning process.*

Planners need to see the "big picture"; to know what planning is, how it is done by the Corps, and what its advantages are. If planners don't know how to plan, other biases aren't going to matter a great deal. *Knowing how to plan is the most straightforward way to deal with the biases mentioned in this chapter.*

To assure elimination of biases, the big picture of planning then has to be sold to the non-Federal partner and key stakeholders as well. Planners need to do a better job of informing those for whom they are planning, of the value of planning. As always, information is the best way of dispelling the biases that are so often at the root of many of the more common planning constraints.

SUMMARY AND LOOK FORWARD

Planning is a messy process beset with numerous biases. Good planning minimizes the mess and eliminates the biases. There is a real need for people doing planning work to take their role as planners seriously. This means they have to know and use the planning process. The next chapter considers opportunities for planning to contribute to the success of the Corps of Engineers of the 21st century.

CHAPTER FOURTEEN: OPPORTUNITIES AND NEW DIRECTIONS

**"Too often, opportunity knocks, but by the time you push back the chair, push back the bolt, unhook the two locks and shut off the burglar alarm, it's too late." Rita Coolidge (1945-)
AMERICAN SINGER.**

INTRODUCTION

On the verge of the 21st century, in a world of changing missions and tight budgets, planning is needed more than ever. No longer is the need for planning confined to the planning divisions of the Corps. Opportunities for planning to help solve the wicked problems the Corps faces abound. At the highest levels of the organization where the future of the agency and new missions are discussed there is a role for planning. Upper level managers struggling with new notions of portfolio management see the value of planning. The need for planning pervades the functional levels of the Corps. Operations and maintenance personnel are forced by tight budgets to plan their O&M work. Long-term dredge material management problems and seeking beneficial uses of dredged material have also served to mainstream principles of planning into the O&M program.

*...planning is
needed more
than ever.*

Construction operations personnel must choose from among options to correct design deficiencies and compare them to continued maintenance, choosing the option that best meets public and agency needs. Military construction branches are formulating alternatives and recommending the best course of action. Resource management personnel evaluate and compare options for getting the Corps' essential support work done. On top of all this, the various entities of the Corps are still called on to participate in interdisciplinary teams for water resource projects that serve new and old missions. *As the need for and use of planning spreads throughout the Corps, the opportunity to improve agency performance and decision-making through sound planning methods presents itself.*

The new opportunities are not recognized by everyone and some have been slower to answer the knock on the door than others. During the preparation of this manual two distinctly different attitudes were encountered among planners. Some have a backward looking attitude and tend to hang their heads in their hands and bemoan the fact that planning is not what it used to be. The big studies are gone. The people who really knew how to plan are no longer around. Planning has fallen out of favor within the Corps. In short, planning's best days are behind it.

Others find this an exciting time to be planning for the Corps of Engineers. Familiar water resource missions continue, if at a reduced level of activity. But, they see exciting new opportunities to extend planning to Corps activities where it had not been used before and to tackle new missions. These people see planning's best days still to come.

The differences in these two groups seem to stem from the planners' sense of their mission to their agency and their Nation. Those with a limited view of planning tend to see it as a means of "finding" projects to construct. The optimists view planning more broadly: as a basic human activity; a way of making rational choices; a means of controlling future consequences; a special kind of problem solving; indeed, as what planners do. For these people, the horizons are full of new opportunities. A rational, thorough, and comprehensive planning process can help solve problems wherever they arise.

A rational, thorough, and comprehensive planning process can help solve problems wherever they arise.

This chapter introduces some of the new opportunities for planning in the Corps of Engineers. The Corps' job is changing, but it has been for two centuries. There are different things to be done, but these are the Nation's new water resources development priorities. *Today's challenge of preserving environmental values, for example, is neither less daunting nor less important than the challenges of uniting the country through a system of inland waterways, making the arid West habitable, or reducing flood damages.* Once an engineer, an economist, or an environmentalist understands the value of and commits to planning, they become something more than they were. No longer discipline bound professionals with a limited view of problems and the future, they become the interdisciplinary problem solvers the Corps needs to step into the 21st century.

RECOGNIZING THE NEED FOR PLANNING

Planning is problem solving and there is no shortage of problems. If planning can improve agency performance through problem solving and informed, rational decision-making it is essential that the need for planning be recognized. Planning offers a structured, rational approach to solving problems. Seen in this broader context of problem solving and considering that all elements of the Corps face problems, it seems downright irrational not to plan.

If one is going to plan, then a structured, rational and thorough approach to planning would have some logical appeal. After all, if we can remove the floundering from our problem solving thought processes, we have nowhere to go but up. Identifying problems, setting clear objectives, collecting the necessary information, formulating alternative solutions that are subsequently evaluated and compared in order to identify the best course of action is, when all is said and done, only common sense. It is a structured, rational and thorough kind of common sense that requires some discipline and practice, but its adherents will be well

rewarded with better decisions. It is not just planning divisions that can benefit from good planning. Anyone with a problem, anyone with a future can benefit from planning.

*Planning...has
been too narrowly
focused...*

NEW DIRECTIONS FOR PLANNING

There are many fruitful areas in which planning can make a significant contribution to the accomplishment of the Corps' various missions. This section describes some of these new directions.

NEW WATER RESOURCES PLANNING

Water resources planning has been and continues to be the foremost arena for planning within the Corps. Flood damage reduction and navigation remain vital needs throughout the Nation. These and other familiar water resource needs have been supplemented in recent years by an expanded environmental mission. In addition, good planning has established its value in a number of operations and maintenance applications.

Environmental Restoration

Environmental restoration outputs are a budget priority for the Corps. The six-step planning process described in this manual is precisely the process that is to be applied to environmental restoration projects. The adaptive management orientation of environmental restoration projects does nothing more than add monitoring to the Corps' planning process. Monitoring project performance provides a feedback loop that enables planners to begin another round of iterations if and when new information comes to light. Environmental restoration, also discussed in Chapter Twelve, does not eschew the planning process, it continues it.

In some districts, environmental planning has been done by environmental specialists, presumably because of the technical nature of the scientific dimensions of the planning process. This is every bit the mistake that letting engineering solutions drive the planning process would be. If we have learned anything from recent planning experience, it is the value of an interdisciplinary approach to planning. *It would appear evident that the consistent application of good planning principles to environmental restoration projects is in the best interests of the Corps and the Nation.*

Watershed Planning

The Corps' expanded environmental mission has brought about something of a revived interest in watershed planning. Adding environmental restoration to the more familiar water resource purposes found in study authorizations has expanded the geographic and substantive scope of many planning studies. Watershed planning resembles the basin level planning studies of the past, though with a more narrow set of objectives.

Wayland (1993) finds watershed planning distinctive because it entails: 1) recognizing that all resources within natural (hydrologically-defined) watershed boundaries are part of interconnected systems and are dependent upon the health of the ecosystem as a whole; 2) identifying priorities and tailoring solutions to the needs of those systems; 3) building partnerships and integrating Federal, state, tribal, regional, territorial, local, and private programs within the watershed; and, 4) obtaining local commitment to implement selected solutions, thereby achieving greater efficiencies and effectiveness through management on a watershed basis. Watershed planning is sometimes called by the names "Consensus Planning", "Total Resources Planning", or "Ecosystem Planning."

The consistent elements of watershed planning include the involvement of local people, reliance on a broad spectrum of expertise, professional judgment, developing plans in a short period of time, and reliance on vast support systems for information, education, and technical assistance. Planners in this "new again" endeavor cannot just be good water resource technicians, though they must be that too. They must also be able to market ideas, know where to get specific expertise, coordinate diverse experts, and maintain good relations with the local political system and other stakeholders. *This substantial undertaking begs for a structure, the structure the six-step planning process can provide.*

Drought Preparation Studies

Several drought preparation studies prototypes were conducted as part of the recent National Drought Study. These studies established a definite role for Corps planners in the formulation of what amount to drought contingency plans. Water supplies, inadequate for a community's current demands, can produce severe problems. With the water shortage come environmental, social, political and economic problems. This mix of problems can put water managers under severe pressure if they are not anticipated in advance of an emergency.

Drought preparation studies allow stakeholders to anticipate and identify potential issues and problems before the pressures of an actual drought make them extant. This affords planners and stakeholders the opportunity to establish planning objectives and to formulate plans for dealing with drought when it does occur.

Traditionally, drought planning has been more a reaction than a conscious, preparatory look forward. *A DPS is action taken by government and community in advance of droughts for the purpose of preparing for the occurrence of droughts, coordinating a proper response to drought, managing water supply and water use during drought, and otherwise mitigating the effects of the impacts associated with droughts.* The six-step planning process has proven to be an effective framework for approaching drought planning. In addition to several site specific DPS's prepared as part of the National Drought Study, *Drought Impacts in a P&G Planning Context*, also demonstrates the suitability of the Corps' planning process to drought preparation studies.

Planning Assistance to States

Section 22 of Public Law 93-251 authorizes the Corps to cooperate with the states in the preparation of comprehensive plans for the development, utilization and conservation of the water and related land resources of drainage basins located within the boundaries of the state. "**Planning Assistance to States**", as this program is called, is one of the Corps' more popular programs.

The six-steps can be iterated in an hour or a year...

This program authorizes the Corps to help the states in virtually any water resource area of interest to them. Section 22 studies provide the Corps with a good opportunity to gain additional experience in areas outside its traditional authorities. Inasmuch as few states have their own formal planning process, there is an additional opportunity to apply the Corps' planning model and to pass it along to peer planners in state government.

In light of the smaller budgets and shorter time frames for Section 22 studies it bears reiterating that the six-step planning process need not be a protracted and plodding process. It is as compatible with intuition and back-of-the-envelope analyses as it is with detailed model studies, simulators, and state-of-the-art analyses. The steps are expanded or contracted according to study circumstances. The number of iterations is limited to what is needed. The six-steps can be iterated in an hour or a year with equal ease.

Operations and Maintenance Functions

In 1982, the Operation and Maintenance, General portion of the Corps' budget exceeded \$1 billion for the first time. By 1985, the O&M portion of the budget exceeded Construction, General for the first time. In terms of the budget, the Corps is now more a **facilities maintenance** organization than it is a construction agency. As this function grows ever larger and more complex, the potential contributions good planning can offer this function grow as well.

Planning can help solve many common O&M problems. For example, dredged material placement has become a critical issue for many districts with a

navigation function. The pass/fail regulatory approach to placement is a situation amenable to a thorough and comprehensively planned approach to dredge material placement, complete with trade-off analyses.

There are trade-offs, for example, between the good that comes from New York Harbor and the harm that might be done by placement of its dredged materials. In other instances there may be options (Section 204, beneficial uses of dredged material) to place materials to create wetlands or fastland. Which should be done? Where? In what quantities? These are the kinds of questions rational planning can answer. Planning in an O&M setting will require a different time frame, it may be guided goals other than NED, and may have a more results-oriented approach, but the process itself need not change.

As 4,000 Corps projects age and deteriorate with wear and tear, more and more of them will require **major rehabilitation** in order to continue to operate. With new technologies, the alternative means of maintaining a project's level of service increase in number. Although the major rehabilitation program restricts service levels to their original design levels, at times it may be feasible to consider changes (increases, decreases or modifications in the mix) to the level of services produced by a project under other authorities.

Selecting the best course of action from among a number of alternatives, requires a set of objectives the decision-maker seeks to achieve. The alternatives need to be thoroughly considered, evaluated, compared and a best course of action chosen. This is the essence of planning. Formal recognition of the contributions, as well as the use of planning in major rehabilitation work, is a win-win situation.

In the Regulatory Program, planning is essential to the development of Special Area Management Plans (SAMP). The 1980 Amendments to the Coastal Zone Management Act define the SAMP process as

"a comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed and comprehensive statement of policies, standards and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone."

Regulatory Guidance Letter 92-3 (19 August 1992) indicates that this process of collaborative interagency planning within a geographic area of special sensitivity is just as applicable in non-coastal areas.

Planning can contribute to the O&M program by introducing rational choices from among a good set of alternatives. It can help solve problems in an objective fashion and, done well, it can help control future conditions. There is already a planning process in place that can do this, the six-step process of this manual!

OTHER PLANNING

While water resources planning remains the Corps' bread and butter, other Corps missions could benefit from the use of a good planning process.

Support for Others/Military

The planning discussed to this point has been primarily for the Corps' Civil Works programs. The Corps also has substantial military obligations and authority. In the 1980s, planners became actively involved in **mobilization master planning**. During this experience the value of planning became evident to many Army personnel. This experience has led to the use of planning in other activities as well.

Master planning is basically the development of long-term plans for the optimal usage of lands and facilities at reservoirs and military installations. It begins with the identification of current and potential future organizational objectives for the purpose of determining the resources available and required to attain those objectives. Plans are developed to make maximum use of the available and anticipated resources in the attainment of the organization's objectives. Military installation master planning might involve housing, office space, production and research facilities, health care, signage infrastructure including water, sewage, street lighting, roads, energy, etc. In other words, it includes anything and everything needed to make the installation effective and efficient in performing its missions. It is basic urban planning adapted for military missions. *The six-step planning process provides the rational structured framework this kind of planning requires.*

Planning has also been used to assist the military construction projects (MCA) program. In these projects a few objectives are established, an estimate of the cost of accomplishing these objectives under a status quo situation is prepared, then one or more alternative ways of accomplishing the objectives are formulated and costed out for the purpose of identifying the best option for attaining the objectives. Though cost efficiency is a planning goal, the alternatives are evaluated and compared to determine if deviation from the least costly alternative is warranted.

This type of planning has been done for child care facilities, family housing, barracks, communications centers, vaccination centers, wastewater treatment, training facilities, research facilities, parking garages, laundry facilities, and many other functions and facilities. A variation of this type of planning is the **project validation assessment (PVA)**. This is a similar type of planning process that is used to obtain funding for projects that have not been appropriated funds. It usually entails a cashflow or pay-back analysis.

Both the MCA and PVA projects lend themselves readily to the rational structure of the planning process described in this manual. Though most of this type of planning has been done for the military, and most of that for the Army, the Corps has provided similar services to other agencies, such as the Department of

Housing and Urban Development. Following the eruption of Mount Pinatubo in the Philippines, Corps planners used the experience and expertise gained in the aftermath of the Mount Saint Helen's eruption to develop recovery and mitigation plans for the Philippine government.

Logistics planning is another area in which planning has made significant contributions. Moving materials and people in the most effective manner that meets the objectives of the move is a natural for planning. Planners have been involved with the **military traffic management command (MTMC)** to help plan movements of Army Reserve and National Guard units at a number of locations throughout the country.

Many of the military issues the Corps addresses qualify as wicked problems. They require consideration of a full range of future oriented options that attain a set of objectives to varying extents, from which the best option should be selected. In other words, planning is sorely needed for many of these problems. The Corps planning process provides an available structure about which a great deal has been learned and that can be readily utilized to improve decision making and problem solving.

...it is up to the planner to prove the value of planning...

Planning may not be something in which the managers of these facilities or the leaders of the various military commands are trained. As a result, it is up to the planner to prove the value of planning in making decisions in an environment where resources are scarce and long-term effects are important. Where planners have initiated this process it has been met with great success and enthusiasm.

Special Projects

Corps offices are occasionally asked to become involved in planning efforts that do not fit neatly into any of the above categories. Special studies are authorized by Congress from time-to-time. Another, more common, example would be district relocation studies or other so-called back-fill studies. The uniqueness of these studies presents substantial challenges to Corps personnel. The availability of a rational planning process to apply to their conduct is a tremendous advantage to the Corps in these circumstances.

In addition to these special studies, strategic planning has become more widely used by Corps offices. The Corps of Engineers now faces an increasingly turbulent, complex, and threatening operating environment. In the past, the Corps could succeed by focusing all of its management efforts on internal functions, running the day-to-day affairs of the agency. Although those internal considerations are still very important, adapting the agency or district to the changing operating environment has become essential for success.

Strategic planning highlights the significance of devoting more attention to analyzing operating environments and formulating strategies that relate directly to environmental conditions. The ultimate purpose of strategic planning is to help the organization, be it the agency, a district, or a division within the district, increase performance through improved effectiveness, efficiency and flexibility. Strategic planning may be defined as the process of examining existing and future environments, formulating the organization's objectives, and making, implementing, and controlling plans focused on achieving these objectives in the existing and future environments.

Strategic planning provides the organization with clear objectives and direction. It helps management focus on future opportunities and problems. It can help the organization to adapt and adjust to relevant environmental conditions. Experience shows that organizations that use strategic planning outperform their own past results as well as organizations that do not plan strategically. Strategic planning is a specific kind of planning, but it is planning and it is amenable to the six-step process.

SUMMARY

Planning isn't just for planners anymore. Planning can contribute to agency performance wherever problems are encountered. When those problems are wicked, planning is indispensable.

This manual has described the Corps' six-step planning process at some length. After all that, there remains a danger that some will consider an iterative six-step planning process as appropriate only for big studies with budgets and schedules to match. That would be a failure of this manual. Planning is a forward thinking, problem solving thought process. When it is given the structure of a specific process, as the Corps' planning process has been, it becomes a more powerful tool.

It is because the Corps' planning process is structured, rational and orderly that it is so valuable. It gives order to a process that can be chaotic. It is a thoughtful superstructure to which people can return as they grapple with difficult problems and messy realities. The structure of the process helps to assure that important steps are not overlooked. The structure assures the thought process can be thorough and comprehensive.

The flexibility of the Corps' planning process cannot be overestimated. As mentioned earlier in this chapter, an iteration of the six steps can be done in an hour or dozens can be done in a year. The effort and detail that goes into the execution of the iterative steps is entirely independent of the process's structure.

Planning need not be conducted by planning division personnel. The planning process described here works as well for career military officers, O&M

personnel, and environmental specialists as it does for professional planners. To do planning well, however, requires an awareness of the process that transcends disciplinary boundaries. Hence, it is not possible to remain simply an engineer or an economist. To do good planning one must learn the process and in following it become a planner too.

Near the turn of the century, planning has more to offer the Corps now than at any point in its history. Planning solves problems and it creates the future for the agency and the Nation.

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**APPENDIX I:
GLOSSARY OF CORPS PLANNING
TERMINOLOGY**

APPENDIX I: GLOSSARY OF CORPS PLANNING TERMINOLOGY

Corps planners have developed a jargon that, though in common usage, can be difficult to understand. Some of these words have been the invention of water resource planners. Others have taken on meanings that differ somewhat from their everyday English meanings. This is not a glossary of all words encountered in the planning process. Words and terms about whose meaning there is no doubt, such as P&G, are not included here. Definitions that can be found in other places, such as national economic development, etc. are, likewise, not repeated here. Commonly used words whose meanings in a Corps planning context do not differ from their Webster's Dictionary meanings are not included here either.

Alternative plans - one or more measures intended to achieve one or more planning objectives at a specific geographic location.

Assessment - ascertaining in a qualitative manner the significance of evaluated effects of alternative plans in light of planning objectives.

Base conditions - the economic, social, environmental and other relevant characteristics of the planning area expected to exist during the base year.

Base year - year in which the project is expected to be operationally complete.

Comparison - examining the evaluated effects of alternative plans on the achievement of planning objectives for the purpose of noting the similarities or differences in their levels of achievement.

Constraint - a limitation or restriction. Planning constraints are things you must avoid doing.

Constraint on planning - something, such as limited time, budget, or expertise, that forces planners to bound the extent of a planning study.

Effects/impacts - the economic, social, environmental and other consequences expected to result from alternative plans. Effects are the differences between the without and with condition scenarios.

Evaluation - ascertaining in a quantitative or qualitative manner the effects of alternative plans on the achievement of planning objectives.

Existing conditions - the economic, social, environmental and other relevant characteristics of the planning area that exist at the time of the study.

Goal - an end or final purpose. Goals are more general than objectives. The Federal objective of NED is a planning goal.

Iterate - to repeat. Iterating the planning steps means repeating each of them.

Most probable future - the projections of basic demographic, economic, social, environmental and other parameters that are used as the basis for defining the without and with project condition scenarios.

Measure - a structural or nonstructural means of managing water or related land resources that contributes to the achievement of one or more planning objectives. A measure may be part of a plan or an entire plan.

Plan formulation - a systematic and rational approach of designing alternative plans that achieve planning objectives to solve existing and future problems.

Planning - the deliberate social or organizational activity of developing an optimal strategy for solving problems and achieving a desired set of goals.

Planning objectives - statement of the intended purposes of the planning process. More specific than goals, they effectively constitute the mission statement of the Federal/non-Federal planning partnership.

Scoping--determining the extent to which a study activity will be considered; defining the extent of perception or intellectual grasp for a study.

Screening--to separate the worthless from the valuable; to separate measures or plans on the basis of their contributions to planning objectives.

With condition - detailed description of the conditions that will most probably prevail over the planning period in the presence of a specific alternative plan to alter the management of water and related land resources. The with condition covers all categories of impacts that are significant in the evaluation of alternative plans. A with plan condition is developed for each alternative.

Without condition - detailed description of the conditions that will most probably prevail over the planning period in the absence of a plan to alter the management of water and related land resources. The without condition covers all categories of impacts that are significant in the evaluation of alternative plans and is the same for all plans.

APPENDIX II: POLICY CONSTRAINTS

APPENDIX II: POLICY CONSTRAINTS

What does it mean "to formulate for _____"?

Often in guidance the statement is made "...plans should be formulated for _____" where the blank is flood damage reduction, storm damage reduction, commercial navigation, or some other "high" priority output. What does this mean? Does this pose a constraint on studies and identification of the NED plan? The answer is YES, and the constraints that are implied by the statement are policy in nature. In conducting planning studies for water resource projects for the Corps of Engineers, it is important for the study team, including the non-Federal partner to recognize and understand the policy constraints which may place limits on the plan formulation process and identification of the NED plan. These constraints affect cost-sharing as well as receiving favorable Administration support for a project.

Some of the more common policy constraints deal with to what extent the Corps will include recreation features in a project. For example, in structural type flood control projects, the Corps must first identify an NED plan for flood damage reduction before recreation will be considered. This means that flood damage reduction benefits must exceed the cost of structural flood damage reduction measures, such as levees, flood walls, channel modifications and storage facilities. Once the NED plan for flood damage reduction structural measures is identified, recreation features can be added so long as they are incrementally justified, are dependent on the structural flood control project, and the additional Federal cost is no more than 10% greater than the Federal cost for the flood control only plan. In the case of non-structural flood damage reduction such as flood plain evacuation, the same policy constraints regarding recreation features do not apply. Specifically, the need to identify a non-structural flood damage reduction project with benefits in excess of costs is not a prerequisite to incorporation of recreation features. Further, there is no prescribed limitation on how much recreation can be included. Basically, all that is required is that the most cost-effective non-structural flood reduction project be identified, but it does not have to be economically justified alone. Therefore, the NED plan can be a fully combined multipurpose plan of flood damage reduction and recreation development.

In the case of commercial navigation and hurricane and storm damage reduction projects, different policy constraints apply to incorporation of recreation features. For example, projects formulated for commercial navigation and/or storm damage reduction do not have to be economically justified on their own merits, but do have to be the most cost-effective plan for those purposes and have to have such benefits exceed 50% of project costs. Once this threshold is met, and unlimited amount of incidental recreation benefits may be used to reach a positive benefit-to-cost ratio. Incidental benefits in this case basically means that no significant costs are incurred to obtain the benefits. In the instance of a commercial navigation

project this could mean that no additional features or alterations of the basic project could be made to capture the recreation benefits, however, additional boat docks and moorage areas may be included by the non-Federal partner as part of associated project costs and features. This would also be applicable to a hurricane and storm damage reduction project. Usually, recreation features would include those required for parking, access, and health and safety.

Another policy limitation pertaining to structural flood damage reduction projects is the requirement to "formulate plan for existing development" [PGI 28]. Because it is considered more important to place limited Federal dollars into the prevention of damages to existing developed properties and to avoid inducing flood plain development, the Corps strives to identify the most cost-effective, economically justified plan to protect existing development. Any project induced growth which may result from some plan is not limited, but the plan must be clearly "formulated" for existing development.

These are just a few of the examples of the implication of "formulation for _____" and how the addition of other project features for additional purposes can be constrained. Basically, "formulating for _____" means identify the most cost-effective plan for the purpose. The need for the benefits of that purpose to exceed the cost varies according to different policies which result in limits on the project formulation process. Again it is important for the planning team and the partner to understand the limitations imposed by these constraints.

APPENDIX III: DO'S & DON'TS OF PLANNING

APPENDIX III: DO'S & DON'TS OF PLANNING

Prior to the writing of this manual a number of experienced Corps planners were interviewed to determine what they would like to see in this manual. As part of this interview process each planner was asked to name three things planners must always do and three things they must never do. The unedited responses are presented in this appendix.

Things Planners Always Must Do

Do...

Use accurate data.

Get the without project condition right. Get the economics and H&H right.

Avoid strategic and unintentional errors.

Define problems accurately. What do people want? what does authority allow?

Have a full understanding of Corps guidance. Know ER 1105-2-100 and the environmental regulations.

Retain your objectivity.

Coordinate with higher authority, especially when innovating.

Carry plan locals want forward in formulation.

Must have clear decision points when plans are eliminated. No revisiting these plans by higher authority.

Someone must be in charge.

Know how things operate. Real world knowledge is essential.

Guard your integrity, your only real resources.

When a decision is made, get in line.

Know how a budget works.

Be able to explain and present what you did orally and in writing.

Communicate effectively. Technology gives us new options for mapping and graphics.

Have a strategy for eliminating and looking at plans.

See and learn the study area.

Seek other opinions.

Recognize the limits of your data. Read the regulations and other guidance.

Involve others in planning from the beginning, especially resource agencies and the local sponsor.

Sell your product. Communicate. You're competing with schools, police, libraries, etc.

Work with your customer.

Get an early buy-in from higher authority.

Make a full disclosure of what you did both internally and externally.

Address a broad range of alternatives.

Tell what you know and don't know about plans.

Quantify deviations from NED.

Get back to basics. Meet the basic requirements.

Look outside the box of your discipline, your agency, your experience.
Get experienced people involved.
Get all the expertise required and give everyone a chance to be heard.
Define the without project condition and lock it in with headquarters.
Interact with sponsor and resource agencies.
Write the report well.
Thinking is encouraged.
Build a project that works.

Things Planners Must Never Do

Don't...
Be biased toward the environment and larger projects.
Leave out a viable solution.
Include unjustified increments that might surface later, even if the locals want them.
Skimp on H&H and economics.
Rely on stovepipe operations that prevent a role for different points of view or disciplines.
Make assumptions that make no sense.
Express planning objectives in terms of measures. Don't state solutions as problems.
Lie.
Be careless playing political games, officials change.
Get blind sided by your own zeal. Be professional but willing to compromise.
Treat problems as solely technical. Technicians run rampant at times.
Ignore mitigation until the end of plan formulation.
Plan in isolation. Work with your customer.
Double count if you're going to get caught.
Begin with the solution.
Have a closed mind.
Have preconceived notion.
Spend money foolishly.
Act stupid.
Focus on cost-sharing until the end.
Focus on the wrong thing at the wrong time.
Focus on a negative.
Build stupid projects.

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